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Waste Acceptance Criteria for ICDF Landfill



Idaho National Engineering and Environmental Laboratory

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ABSTRACT

The Idaho National Engineering and Environmental Laboratory (INEEL) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility landfill will accept CERCLA waste generated within the INEEL. Hazardous, mixed, low-level, and Toxic Substance Control Act waste will be accepted for disposal at the INEEL CERCLA Disposal Facility (ICDF) landfill. The purpose of this document is to provide the basis for the quantities of radioactive and nonradioactive waste allowable in waste designated for disposal in the INEEL CERCLA Disposal Facility landfill.

The *ICDF Complex Waste Acceptance Criteria* document contains the overall waste acceptance criteria. As such, the compliance details that are the same for all areas of the ICDF Complex are referenced to that document.

This document specifies the chemical and radiological waste acceptance criteria for waste that will be disposed of at the landfill. Compliance with the requirements of this document will ensure protection of human health and the environment, including the Snake River Plain Aquifer. Waste placed in the ICDF landfill must not cause groundwater in the Snake River Plain Aquifer to exceed maximum contaminant levels, a hazard index of 1, or 10^{-4} cumulative risk levels.

The defined waste acceptance criteria concentrations are compared to the design inventory concentrations. The purpose of this comparison is to show that there is an acceptable uncertainty margin based on the actual constituent concentrations anticipated for disposal at the ICDF.

CONTENTS

ABSTRACT.....	iii
ACRONYMS.....	ix
NOMENCLATURE	xi
1. INTRODUCTION.....	1-1
1.1 Purpose and Objectives	1-1
1.2 Scope	1-2
1.3 Relationship to Other Documents	1-2
1.3.1 Operable Unit 3-13 Record of Decision.....	1-2
1.4 Responsibilities	1-3
2. WASTE PROFILE PROCESS.....	2-1
2.1 General Requirements	2-1
2.2 Physical and Chemical Characterization	2-2
2.2.1 Acceptable Knowledge Requirements	2-2
2.2.2 Implementation of the Data Quality Protocol	2-3
2.2.3 Land Disposal Restriction Knowledge.....	2-3
2.2.4 Exceptions to Physical and Chemical Characterization Requirements	2-3
2.3 Radiological Characterization	2-4
2.3.1 Identification of Major Radionuclides	2-4
2.3.2 Acceptable Knowledge and Methods for Establishing Radionuclide Inventories.....	2-4
2.3.3 Additional Detail on Mobile Radionuclide Characterization.....	2-5
2.4 Waste Flow-Through Process.....	2-5
2.5 Waste Acceptance Scheduling Requirements	2-6
2.5.1 Long-Term Schedule.....	2-6
2.6 Criteria Basis	2-6
2.6.1 Protection of Human Health and the Environment	2-6
2.6.2 Compliance with Applicable or Relevant and Appropriate Requirements	2-7
2.7 Development of Numerical Waste Acceptance Criteria.....	2-9
2.8 Tracking Waste Acceptance Criteria During Operations	2-10

3.	ACCEPTANCE CRITERIA FOR THE ICDF LANDFILL	3-1
3.1	Prohibited Waste	3-1
3.1.1	Waste with >10 nCi/g Transuranic Constituents.....	3-1
3.1.2	Toxic Substances Control Act Waste Containing >500 ppm Polychlorinated Biphenyls	3-1
3.1.3	Free Liquids	3-1
3.1.4	Waste Capable of Detonation, Explosive Decomposition, or Reaction.....	3-1
3.1.5	Waste Capable of Generating Toxic Gases, Vapors, or Fumes	3-1
3.1.6	Gaseous Waste	3-1
3.1.7	Waste Exceeding the Class C Limit.....	3-2
3.1.8	Waste Containing Greater than 1% Chelating Compounds by Weight	3-2
3.1.9	Spent Nuclear Fuel and High-Level Waste.....	3-2
3.2	Restricted Types of Waste Requiring Treatment	3-2
3.3	Physical and Chemical Criteria	3-3
3.3.1	Liquid and Liquid-Containing Waste.....	3-3
3.3.2	Land Disposal Restrictions.....	3-3
3.3.3	Solidification or Stabilization of Organic Liquids and Chelating Compounds	3-3
3.3.4	Asbestos-Containing Waste	3-4
3.3.5	Heat Generation	3-4
3.3.6	Gas Generation.....	3-4
3.3.7	Physical Limits.....	3-4
3.4	Radiological Criteria	3-5
3.4.1	Radiological Inventory Limits	3-5
3.4.2	Criticality Safety Limits.....	3-5
3.4.3	Package External Concentration Limits.....	3-5
3.4.4	Package Dose Rate Limits.....	3-5
3.4.5	Noncontact-Handled Waste.....	3-5
3.4.6	Minimizing Subsidence.....	3-5
3.5	Numerical Criteria.....	3-6
3.6	Packaging Criteria	3-12
4.	REFERENCES	4-1
	Appendix A—Remedial Action Objective Criteria	A-1

TABLES

2-1.	Schedule for CERCLA project and ICDF Complex interaction	2-2
2-2.	Mobile radionuclides	2-5
3-1.	Treatment requirements for ICDF landfill restricted waste.....	3-2
3-2.	Physical limits for ICDF landfill proposed waste	3-4
3-3.	The ICDF landfill waste acceptance criteria	3-6

ACRONYMS

AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EDF	Engineering Design File
EPA	U.S. Environmental Protection Agency
HI	hazard index
ICDF	INEEL CERCLA Disposal Facility
INEEL	Idaho National Engineering and Environmental Laboratory
LDR	land disposal restriction
MCL	maximum contaminant level
OU	operable unit
PCB	polychlorinated biphenyl
PPE	personal protective equipment
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SRPA	Snake River Plain Aquifer
SSSTF	Staging, Storage, Sizing, and Treatment Facility
TCLP	toxicity characteristic leaching procedure
TRU	transuranic
TSCA	Toxic Substances Control Act
UTS	Universal Treatment Standard
WAG	waste area group

NOMENCLATURE

The following definitions are presented as an aid to the reader for understanding the technical and scientific terms used in this document.

Analytical residue and sample preservative residue: Aqueous and organic solutions from sample preservatives and analytical residue generated from field preparation and laboratory analyses.

CERCLA-derived remediation and removal waste: Waste from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities that may include, but are not limited to, the following: soil, water, debris, contaminated personal protective equipment (PPE), filters, and other support equipment that cannot be decontaminated.

Construction waste: Waste generated during the on-Site construction of CERCLA activities.

Contaminated equipment: Contaminated equipment becomes a waste stream if it cannot be properly decontaminated or reused.

Debris: Solid material exceeding a 60-mm particle size that is a manufactured object, plant, or animal matter, or natural geologic material intended for disposal. However, the following materials are not considered to be debris:

- Any material for which a specific treatment standard is provided in 40 CFR 268, Subpart D (e.g., lead acid batteries, cadmium batteries, and radioactive lead solids)
- Process residuals, (e.g., smelter slag and residues from the treatment of waste, wastewater, sludge, or air emission residues)
- Intact containers of hazardous waste that retain at least 75% of their original volume.

A mixture of debris and other material that has not been treated to the standards provided by 40 CFR 268.45 is subject to regulation as debris, if the mixture is composed primarily of debris, by volume based on visual inspection.

Drill cuttings: Soil generated from boring and drilling activities. Perched water and Snake River Plain Aquifer (SRPA) water well installation is expected to generate a substantial volume of drill cuttings.

Free liquids: Liquids that can be readily separated from the solid portion of a waste under ambient temperature and pressure (DOE Order 435.1), as demonstrated by “Environmental Protection Agency Paint Filter Liquids Test Method 9095.”

Hazard index: The sum of more than one hazard quotient where the U.S. Environmental Protection Agency (EPA) goal is a value not to exceed 1.

Hazard quotient: The ratio of a single substance exposure level, over a given time period, to a reference exposure level at which no adverse effects are likely to occur.

Hazardous debris: Debris that contains a hazardous waste listed in 40 CFR 261, Subpart D, or that exhibits a characteristic of hazardous waste identified in 40 CFR 261, Subpart C.

Hazardous substances: Any material designated as such pursuant to CERCLA, including all Resource Conservation and Recovery Act (RCRA) hazardous waste, radionuclides, a variety of other chemical substances, and any material identified as a hazardous substance (such as petroleum, petroleum products, and all hazardous waste).

Hazardous waste: Waste designated as hazardous by EPA regulations (40 CFR 261.3) and regulated under RCRA.

High-level waste: Highly radioactive waste material. High-level waste results from the reprocessing of spent nuclear fuel, including the liquid waste produced directly during reprocessing. In accordance with DOE Order 435.1, the term refers to any solid material derived from such liquid waste that contains fission products in sufficient concentrations and to other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. (Adapted from *Nuclear Waste Policy Act of 1982*, as amended.)

Hydraulic spills: Unintentional releases of hydraulic fluid. Spills that occur when hydraulic fluid leaks from equipment seals or through ruptured hoses.

Infectious waste: Waste containing living organisms that could endanger human health or the health of domestic animals or wildlife by extending the range of biological pests, viruses, pathogenic microorganisms, or other agents capable of infesting, infecting, or extensively and permanently altering the normal populations of organisms.

Investigation-derived waste: Materials that are generated from CERCLA investigations, such as drill cuttings, purge water, development water, overburden, interstitial and underburden soil, and waste (e.g., debris, sludge).

Low-level radioactive waste: Waste that cannot be defined as high-level radioactive waste, spent nuclear fuel, transuranic (TRU) waste, by-product material (as defined in Section 11e [2] of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material (DOE Order 435.1).

Miscellaneous waste: Nonrecyclable, unwanted material (e.g., trash, labels, rags, and other debris).

Mixed waste: Waste containing both radioactive components as defined by the *Atomic Energy Act of 1954* (as amended) and hazardous components as defined by 40 CFR 262.

Personal protective equipment: Items worn or used during waste-handling activities (e.g., coveralls, shoe covers, boots, gloves, glove liners, hoods, and duct tape). Coveralls and hoods are generally made of cloth, paper, or synthetic material. Gloves are generally latex or nitrile, and glove liners are made of disposable cloth material. Shoe covers and boots are generally rubber.

Purge/development water: Water generated from well development or during sampling that is removed from a well before samples are collected.

Radioactive waste: Solid, liquid, or gaseous material that contains radionuclides regulated under the *Atomic Energy Act of 1954* (as amended), which is of negligible economic value considering costs of recovery.

RCRA Facility means:

- (1) All contiguous land, structures, other appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).
- (2) For the purpose of implementing corrective action under 40 CFR 264.101, all contiguous property under the control of the owner or operator seeking a permit under Subtitle C of RCRA. This definition also applies to facilities implementing corrective action under RCRA Section 30008(h).
- (3) Notwithstanding paragraph (2) of this definition, a remediation waste management site is not a facility that is subject to 40 CFR 264.101, but is subject to corrective action requirements if the site is located within such a facility.

Sample containers: Vessels composed of steel, aluminum, Teflon, brass, glass, or plastic used to contain samples of water, soil, or other media. Once used, these containers become a waste stream if they cannot be decontaminated for reuse.

Secondary waste: A generic category of waste that is generated from support activities (including operations and maintenance activities) related to retrieving, processing, and packaging the investigation-derived materials. Examples of secondary waste include waste associated with routine decontamination activities (excluding facility closure), PPE, administrative area and support services waste, used equipment and filters, and other similar waste generated during operations and maintenance activities.

Soil waste: Soil excavated as part of a project that may be contaminated as a result of spill and pipeline leaks or radioactive liquids from plant liquid transfer operations.

Solidification: A technique that limits the solubility and mobility of hazardous waste constituents through physical means. This process changes the physical state from liquid or semisolid to a solid.

Spent nuclear fuel: Fuel that has been withdrawn from a nuclear reactor following irradiation and that has not yet been reprocessed to remove its constituent elements.

Stabilization: A technique that limits the solubility and mobility of hazardous waste constituents by causing the constituents to bond or chemically react with the stabilizing material.

Structural stability: A waste form that will generally maintain its physical dimensions and its form under the expected disposal conditions, such as weight of overburden and compaction equipment, the presence of moisture and microbial activity, and internal factors such as radiation effects and chemical changes. The waste form itself can provide structural stability by processing the waste to a stable form or by placing the waste in a disposal container or structure that provides stability after disposal.

Toxic Substances Control Act waste: Waste managed strictly under Toxic Substances Control Act (TSCA) regulations. Currently, only polychlorinated biphenyls (PCBs) and asbestos are regulated under TSCA as waste.

Transuranic waste: In accordance with DOE Order 435.1, radioactive waste containing more than 100 nanocuries (3,700 becquerels) of alpha-emitting transuranic (TRU) isotopes per gram of waste, with half-lives greater than 20 years, except for (1) high-level radioactive waste; (2) waste that the U.S. Secretary of Energy has determined—with the concurrence of the administrator of EPA—does not need the degree of isolation required by the 40 CFR 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. (Source: *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended).

Unused and unaltered sample material: Material that may include excess soil cores from the interbeds, underlying basalt, and groundwater.

Void space: *Compressible void space:* Space that is compressible through the application of load or settlement over time (e.g., interstitial space in soil, empty space in wooden boxes of soil). *Incompressible void space:* Percent of voids in waste that is encased in a cement enclosure (e.g., void space within a container that has been filled with concrete).

Waste Acceptance Criteria for the ICDF Landfill

1. INTRODUCTION

The Idaho National Engineering and Environmental Laboratory (INEEL) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) landfill will accept only low-level, mixed low-level, hazardous, and Toxic Substances Control Act (TSCA) waste generated from INEEL CERCLA activities for disposal. Current projections of Sitewide CERCLA waste volumes total about 510,000 yd³. Most of the waste will be contaminated soil, but debris and CERCLA investigation-derived waste also are included in the waste inventory.

This document details the criteria that must be satisfied prior to the ICDF landfill acceptance of waste for disposal. Compliance with the ICDF landfill waste acceptance criteria will ensure protection of human health and the environment, including the Snake River Plain Aquifer (SRPA). Waste placed in the ICDF landfill must not cause groundwater in the SRPA to exceed Idaho maximum contaminant levels (MCLs), 10⁻⁴ cumulative risk levels, or a hazard index (HI) of 1. Exposure to members of the public has been evaluated for two scenarios: (1) as visitors to the ICDF Complex who have had appropriate health and safety training and on-Site briefing and (2) as visitors to the Central Facilities Area (e.g., delivery services with no special training).

1.1 Purpose and Objectives

The purpose of this document is to provide the limits for quantities of radioactive and nonradioactive constituents that may be accepted for disposal at the ICDF landfill. The objectives of the ICDF landfill waste acceptance criteria are to ensure the following:

- Waste placed within the ICDF landfill will not exceed the allowable limits for protection of the SRPA in accordance with the *Final Record of Decision Idaho Nuclear Technology and Engineering Center* (ROD) requirements (DOE-ID 1999)
- The commitments in the ROD (DOE-ID 1999) to meet the remedial action objectives (RAOs) are met and maintained
- Waste received at the ICDF landfill contains only the radionuclides and hazardous constituents that the facility can safely manage to protect human health (workers and the public) and the environment
- The concentrations and/or total activities of the waste received at the ICDF landfill are compatible with the ICDF landfill design and operations
- Waste received at the ICDF landfill is in a form or container that will maintain its integrity and retain acceptable configuration under the conditions expected to be encountered during ICDF Complex operations and closure.
- Waste received at the ICDF landfill does not contain materials that will compromise the safety or integrity of the facility under the expected operating conditions. For example, waste with significant voids could compromise the cover integrity due to subsidence; reactive waste could compromise worker safety; and liner-incompatible waste could compromise liner integrity.

1.2 Scope

Landfill-specific acceptance criteria (e.g., numerical chemical and radiological concentrations) have been developed for the landfill and are included in this document. Development of the chemical and radiological acceptance criteria for the landfill included calculations to determine concentrations in the ICDF landfill leachate that are protective of the evaporation pond liner system, SRPA, and human health and the environment. Generic criteria that must be met by all waste entering the ICDF Complex gates are referenced to specific sections of the *ICDF Complex Waste Acceptance Criteria* (DOE-ID 2003a).

The ICDF Complex, including the ICDF landfill cells, will be designed to meet the substantive requirements of DOE Order 435.1, “Radioactive Waste Management,” Resource Conservation and Recovery Act (RCRA) Subtitle C minimum technology requirements (40 CFR 264, Subpart N requirements, “Landfills”), and the applicable sections of TSCA polychlorinated biphenyl (PCB) design and construction specifications. The ICDF landfill is designed and managed to meet the National Contingency Plan requirement of a maximum 15-mrem/yr exposure to the public. The ICDF landfill will be authorized to accept waste generated within the INEEL from CERCLA removal/remedial and investigative activities at the INEEL waste area groups (WAGs).

The ICDF landfill is designed and designated to accept ICDF CERCLA remediation waste generated within the ICDF Complex and from CERCLA removal/remedial and investigative activities at the INEEL WAGs that meet the ICDF landfill waste acceptance criteria for disposal.

The ICDF Complex users must obtain approval from the ICDF Complex operations manager prior to shipment. Waste that can be accepted at the ICDF landfill includes the following:

- WAG 3 CERCLA remediation waste, including soil, drill cuttings, building debris, boxed soil, and secondary remediation waste (e.g., personal protective equipment [PPE]).
- Waste generated in the ICDF Complex and from CERCLA investigative, remedial, and removal activities at the INEEL WAGs. The waste will include soil, drill cuttings, building debris, stabilized waste, and secondary remediation and investigation waste.
- Secondary CERCLA waste from waste processing and decontamination activities in the Staging, Storage, Sizing, and Treatment Facility (SSSTF) and INEEL WAGs.

1.3 Relationship to Other Documents

This document is based on and integrated with several related documents, as discussed in the following sections.

1.3.1 Operable Unit 3-13 Record of Decision

The *Final Record of Decision Idaho Nuclear Technology and Engineering Center* (ROD) (DOE-ID 1999) is the regulatory authorization for the ICDF Complex. This document includes the regulatory basis for the ICDF landfill and the applicable or relevant and appropriate requirements (ARARs) that the ICDF Complex must meet. The ROD also describes the area of contamination (AOC) for WAG 3. Because the ICDF Complex will receive waste from both inside and outside the AOC, this document has different requirements for mixed waste from inside and outside the AOC. These AOC issues are addressed in more detail in the waste acceptance criteria basis (Section 3.1).

1.4 Responsibilities

The INEEL organizations operating and using the ICDF Complex are responsible for performing activities in accordance with this document. A system of checks and balances is in place to ensure the appropriate level of coordination between ICDF Complex personnel and the various users. A series of interface points are designed to communicate waste receipt schedules, waste quantity and form, characterization information, waste certification, treatment requirements, packaging, transportation, documentation, receipt, and disposal.

2. WASTE PROFILE PROCESS

2.1 General Requirements

The waste profile process described in the subsequent sections ensures that each waste stream entering the ICDF Complex meets the requirements of the appropriate waste acceptance criteria. The process described in the following sections must be implemented for each waste stream generated that is destined for the ICDF Complex. For clarity, the process has been outlined, including assigning tasks to the appropriate personnel (e.g., the generating site, and the ICDF Complex personnel).

The generating site will:

- Notify ICDF Complex operations personnel of waste generation schedules (as described in Table 2-1)
- Complete a waste profile for each waste stream prior to waste generation (Appendix A of the *ICDF Complex Waste Acceptance Criteria* [DOE-ID 2003a])
- Obtain additional characterization data as required by ICDF review
- Ensure waste is properly packaged, marked, and labeled
- Characterize each waste stream by acceptable process knowledge or analytical results described in the Section 4.1 of *ICDF Complex Waste Profile and Verification Sample Guidance* (WPVSG) (DOE-ID 2004)
- Complete a waste profile for each waste stream in the tracking system database as described in Section 4.2 of the WPVSG
- Complete the waste certification form as described in Section 3.6 of the *ICDF Complex Waste Acceptance Criteria* (DOE-ID 2003a)
- Notify ICDF Complex operations designee that the waste profile is ready for approval
- Coordinate shipment to the ICDF Complex with ICDF Complex operations personnel and generate shipment documentation
- Submit waste profile folder (waste profile and supporting documentation) to ICDF Complex records personnel.

Table 2-1 lists the major planning steps that must be performed for shipping waste to the ICDF Complex.

Table 2-1. Schedule for CERCLA project and ICDF Complex interaction.

Information	Information Due Date to ICDF Complex Management
CERCLA project name	6 months prior to anticipated ship date
Anticipated waste type	6 months prior to anticipated ship date
Projected schedule for waste generation	6 months prior to anticipated ship date
Waste profile and characterization information	Optimally, the profile should be submitted 3 months prior to waste stream approval; however, extenuating circumstances (e.g., budget issues, company milestones, waste stream size, and complexity) may require or allow an accelerated review.
Waste Tracking System waste profile approval	3 months prior to anticipated ship date
Preliminary acceptance and authorization to ship	6 weeks prior to anticipated ship date
Shipping schedule (number of trucks/containers per day) and days of shipment	1 week prior to first ship date
Receipt of waste volume	Actual ship date

2.2 Physical and Chemical Characterization

For all waste, a detailed record must be kept of the contents, volume, and weight, as well as any added void fillers, sorbents, stabilization agents, or solidification agents. The generators must also provide, in accordance with all applicable regulations (i.e., acceptable knowledge), the information required for the waste profile and that required by the appropriate WAC. The following sections describe the physical/chemical characterization requirements for waste acceptance (40 CFR 264.13, “General Waste Analysis,” 40 CFR 761, “Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions”).

2.2.1 Acceptable Knowledge Requirements

When a waste designation is based on process knowledge, the generating site must ensure that the chemical, physical, and radiological properties of the waste are adequately determined. The logic used to make the designation must be documented. The technical basis, including documented historical information, procedures, practices, and information gained from interviews shall be documented. Any assigned listed waste codes apply to the waste stream throughout the disposition process.

Analytical data and/or knowledge of the waste must be sufficient to determine whether the waste is regulated under 40 CFR 261, “Identification and Listing of Hazardous Waste,” or 40 CFR 761, and to assign correct hazardous waste codes (when applicable). When the available information does not qualify as acceptable knowledge, or is not sufficient to characterize a waste for management, the sampling and testing methods commonly used to make a hazard determination may be required. The presence or absence of hazardous constituents by chemical analysis alone does not indicate that a listed waste is present. The only way a listed waste code can be assigned to a waste stream is through process knowledge.

If constituents that could cause a waste to be listed are present in a process, but are not expected to be in the waste in concentrations causing the waste to be above land disposal restrictions (LDRs) (e.g., those wastes that have been generated outside the WAG 3 AOC or that have triggered placement), sampling and analysis must be performed to demonstrate that the constituents are below regulatory limits for land disposal. This requirement can be met through previous investigations, such as remedial investigations/feasibility studies (RI/FSs) or other CERCLA investigations. This sampling and analysis is required only for initial characterization of the waste stream.

Listed waste must be designated based on process knowledge. Other waste stream designations may be based on process knowledge and/or analytical data. The generating CERCLA project will perform a review to determine whether a listed waste source is present at the remediation waste site. The listed waste review will rely on readily available documents gathered as a part of the standard CERCLA site evaluation or RI/FS. For CERCLA operable units (OUs) from which listed waste sources are reasonably expected, standard operator interviews should be augmented and documented as necessary to ask questions specifically aimed at identification of potential sources.

2.2.2 Implementation of the Data Quality Protocol

See the *ICDF Complex Waste Profile and Verification Sample Guidance* (DOE-ID 2004) for data quality guidance.

2.2.3 Land Disposal Restriction Knowledge

For hazardous waste (as defined in 40 CFR 261) that has been generated outside the WAG 3 AOC (or has triggered placement), waste characterization must be sufficient to establish whether the waste is a restricted waste under the LDR provisions of 40 CFR 268, “Debris–Land Disposal Restrictions,” or the alternative LDR treatment standards for contaminated soil under 40 CFR 268.49, “Alternative LDR Treatment Standards for Contaminated Soil.” If either of the LDR provisions applies, the applicable treatment standard(s) for that waste must be determined. Data from a CERCLA RI/FS can be utilized for this demonstration if the sample is a representative sample as defined in 40 CFR 260.10, “Definitions-Hazardous Waste Management System: General,” and the appropriate parameters were analyzed. Additional testing of a representative sample of the waste stream may be required to clarify that the waste meets a concentration-based treatment standard of 40 CFR 268 or 40 CFR 268.49.

2.2.4 Exceptions to Physical and Chemical Characterization Requirements

The following exceptions can be made to the physical/chemical characterization requirements stated previously:

- Hazardous debris managed in accordance with the alternative treatment standards for hazardous debris (40 CFR 268.45, “Treatment Standards for Hazardous Debris,”) does not require sampling and analysis for adequate physical/chemical characterization
- Waste that cannot be characterized in accordance with the requirements stated previously (due to factors such as unique chemical or radiological hazards of the waste) can be characterized by an alternative management path negotiated with the ICDF Complex management.

2.3 Radiological Characterization

The major radionuclides (as defined below) in the waste, and the concentration of each major radionuclide, must be established with sufficient sensitivity and accuracy to properly classify and manage the waste in accordance with the radiological limits.

2.3.1 Identification of Major Radionuclides

For the purposes of the radiological criteria in this document, major radionuclides are defined as those radionuclides that meet any of the following conditions:

- Any transuranic (TRU) radionuclides present in the nonaqueous waste in a concentration exceeding 1 nCi/g
- Any TRU radionuclides present in the aqueous waste in a concentration exceeding 1 nCi/L
- Any radionuclide that accounts for more than 1% of the total radiological activity of the waste
- Any fissionable radionuclide present in the waste in a quantity exceeding 0.1 fissile gram equivalent present per container
- Any mobile radionuclide present in a concentration that exceeds its reporting limit.

2.3.2 Acceptable Knowledge and Methods for Establishing Radionuclide Inventories

The radionuclide inventory of a waste must be established through the use of a method or combination of methods capable of identifying and quantifying the major radionuclides present. The methods chosen must provide adequate sensitivity and accuracy to ensure that the waste meets the criteria.

Both direct and indirect methods can be used for radiological characterization. Indirect methods (i.e., methods other than direct measurement of a given radionuclide) are acceptable as outlined in the *Federal Register*, November 20, 1997, "Clarification of RCRA Hazardous Waste Testing Requirements for Low-Level Radioactive Mixed Waste—Final Guidance," (62 FR 224):

This guidance encourages mixed waste handlers to use waste knowledge, such as process knowledge, where possible, in making RCRA hazardous waste determinations involving mixed waste.

The same guidance states:

Because mixed waste testing may pose the possibility of increased radiation exposure, this guidance also describes methods by which individuals who analyze mixed waste samples may reduce their occupational radiation exposure and satisfy the intent of RCRA testing requirements.

The following characterization methods can be used individually or in combination to establish the radionuclide inventory of the waste:

- Process knowledge

- Direct measurement field and laboratory analysis methods
- Computer modeling
- Scaling factors.

2.3.3 Additional Detail on Mobile Radionuclide Characterization

For low-level waste and low-level mixed waste, mobile radionuclide reporting is necessary for compliance with the ICDF Complex performance assessments. Because of the low reporting limits and analysis difficulty of certain mobile radionuclides, this section provides additional detail concerning acceptable knowledge and characterization.

The concentration of each mobile radionuclide must be established with the appropriate reporting limit using process knowledge and/or analysis or other available information. Table 2-2 is a list of mobile radionuclides and the reporting limits. If process knowledge alone is used to determine that a mobile radionuclide is not present in a waste stream at the reporting limit, the basis for this determination must be clearly documented. If available analysis techniques cannot detect a mobile radionuclide at its reporting limit, the concentration could be estimated using a combination of process knowledge, scaling factors, and analytical detection limits. Mobile radionuclide reporting is intended to measure only the quantity of isotopes that exceeds INEEL Site natural background concentrations. For waste forms that contain a mobile radionuclide (uranium) that originates from natural background on the INEEL Site, the background concentration of that radionuclide will be subtracted from the total concentration.

Table 2-2. Mobile radionuclides.

Mobile Radionuclide	Reportable Concentration (pCi/g)
H3	2.9E+06
C14	8.7E+01
Cl36	2.1E+01
Se79	2.3E+01
Mo93	2.3E+01
Tc99	1.4E+02
I129	6.7E-01
Re187	2.2E+04
Np237	7.3E+00
UTOT	9.3E+00

2.4 Waste Flow-Through Process

Waste entering the ICDF Complex shall be controlled on the basis of source, physical form, and concentration levels. A uniform and consistent waste acceptance process shall be implemented to include planning, waste certification, waste shipment, and waste receipt verification.

2.5 Waste Acceptance Scheduling Requirements

All ICDF Complex users shall provide long-term and operational project schedules to the ICDF Complex management and operations team for use as a planning tool. Failure to provide the ICDF Complex management and operations team with project schedules or to participate in routine planning discussions may result in delays to the acceptance process.

2.5.1 Long-Term Schedule

For projects anticipating disposal of waste in the ICDF Complex, the generating site shall submit an overall project schedule to the ICDF Complex operations manager. Information necessary for the long-term scheduling includes, at a minimum, the following:

- Planned start date
- Planned completion date
- Waste volume
- General class of waste (as described in ICDF Complex WAC [DOE-ID 2003a] Section 2.2)
- Primary waste forms (e.g., soil, concrete, purge water, other aqueous waste, steel, wood asbestos)
- Potential radioactive and hazardous constituents
- Applicable listed waste codes
- Waste disposition pathway (e.g., ICDF landfill, ICDF evaporation pond, treatment at the SSSTF, staging, storage, or off-Site disposal)
- Special handling requirements, including anticipated need for treatment at the SSSTF, as applicable.

2.6 Criteria Basis

The ICDF landfill is authorized to accept CERCLA waste from INEEL activities consistent with the ROD (DOE-ID 1999). This section develops the basis for the ICDF Complex waste acceptance criteria numerical criteria. The actual numerical criteria are presented in Section 5. The basis for acceptance criteria includes protection of human health, including worker health and safety and the environment; protection of the ICDF landfill liner system; control of waste form; and compliance with environmental regulations' ARARs as authorized by the ROD (DOE-ID 1999). These criteria have provided the basis for developing chemical, radiological, and physical waste acceptance criteria.

2.6.1 Protection of Human Health and the Environment

Worker protection shall be provided by compliance with the requirements of the *Health and Safety Plan for INEEL CERCLA Disposal Facility Operations* (INEEL 2003).

The waste handling at the ICDF landfill shall maintain worker exposure as low as reasonably achievable in accordance with DOE Order 5400.5, "Radiation

Protection of the Public and the Environment.” Therefore, risks to workers have no limited allowable waste acceptance criteria concentrations, but standard DOE protocol will limit worker exposures to ensure worker protection.

The RAOs for the ICDF Complex relating to intrusion (DOE-ID 1999, page 8-3) are defined as follows:

Maintain the closed and capped ICDF Complex to prevent exposure to the public to a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

Appendix A summarizes the development of the waste acceptance criteria for specific radionuclide and chemical constituents, which was based on evaluation of risk via the groundwater ingestion pathway.

2.6.2 Compliance with Applicable or Relevant and Appropriate Requirements

The ICDF Complex is a part of a CERCLA remedial action, and the ARARs are clearly identified in the ROD (DOE-ID 1999). Compliance with these ARARs is documented in the *INEEL CERCLA Disposal Facility Remedial Design/Construction Work Plan*, (DOE-ID 2002). Specific prohibited waste types are discussed in Section 3.1 of this document. The ARARs that affect the waste acceptance criteria are those that limit the types of waste and concentrations/activities that are allowed to enter the landfill. The specific ARARs that affect the waste acceptance criteria for various constituents are in the following sections.

2.6.2.1 Hazardous Waste. Waste not subject to LDRs and originating inside the WAG 3 AOC (that has not triggered placement) is acceptable for direct disposal in the ICDF landfill without the need to meet the RCRA LDRs specified in the ROD (DOE-ID 1999), provided that the waste meets the appropriate waste acceptance criteria.

Hazardous waste from outside the WAG 3 AOC, or hazardous waste from inside the WAG 3 AOC that has triggered placement, is prohibited from disposal at the ICDF landfill unless it meets RCRA LDRs of 40 CFR 268, 40 CFR 268.45, or 40 CFR 268.49.

2.6.2.2 Waste Outside Area of Contamination, and Area of Contamination Waste that has Triggered Placement. Waste originating from outside the AOC, or that has triggered placement, must comply with RCRA ARARs for land disposal. The ICDF Complex users shall determine whether waste is subject to RCRA LDRs by completing a hazardous waste determination. If the waste is determined to be hazardous, the user will be responsible for evaluating concentrations for the constituents of concern against the applicable treatment standards or prohibition levels. The federal treatment standards and prohibition levels that apply to LDR waste are published in 40 CFR 268.48, “Universal Treatment Standards,” and 40 CFR 268.49, “Alternative LDR Treatment Standards for Contaminated Soil.” For other waste codes or constituents refer to 40 CFR 268.40, “Treatment Standards,” 40 CFR 268.48, and 40 CFR 268.49 for applicable LDRs. The 1999 edition of the CFR shall be used for consistency with the ARARs cited in the ROD (DOE-ID 1999). For waste that is hazardous by characteristic, the underlying hazardous constituents specified in 40 CFR 268.48 that reasonably can be expected to be present at the point of generation of the hazardous waste also shall be evaluated. Soil waste will be treated to the alternative LDR treatment standards for contaminated soil (40 CFR 268.49).

Waste profile documentation for all hazardous waste shipped to the ICDF Complex shall include information similar to that found in 40 CFR 268.7, “Testing, Tracking, and Recordkeeping Requirements for Generators, Treaters, and Disposal Facilities,” including waste code and applicable treatment standard, subcategory, and underlying hazardous constituents. If the treatment standard is expressed in terms of a

concentration limit, the actual concentration of the restricted constituent also shall be reported. If the waste has no listed waste codes and no longer exhibits the characteristic of a hazardous waste because it has been treated, then the land disposal restriction notification shall include a statement describing the treatment technology that was used and the reason the waste is no longer hazardous.

Waste from within the AOC may be staged or stored in a manner that triggers placement. If waste from within the AOC triggers placement, then the waste must comply with LDRs. Waste that has been treated to meet the LDR for characteristic waste also must meet the Universal Treatment Standard (UTS) for underlying hazardous constituents for those constituents that are reasonably expected to be present. The generator must determine whether a waste is listed or characteristic and must document the determination.

The determination of a characteristic waste may be based on comparison to the toxicity characteristic leaching procedure (TCLP) regulatory levels. If the total metals' concentrations exceed the associated TCLP regulatory levels for characteristic waste by more than 20 times, then TCLP analysis might be necessary to determine if the waste is RCRA characteristic. For waste containing organic constituents that would cause the waste to be characteristic by TCLP, the constituent must be present below the applicable LDR and UTS levels for the waste to be accepted into the ICDF landfill. In the case of organic constituents, concentrations below the 20 times rule can be used to show that a TCLP analysis is not required. For concentrations over 20 times, if other information is not available to quantitatively show the waste is not hazardous, then a TCLP analysis will be performed.

2.6.2.3 Organic Constituents. Soils containing PCBs are limited to 500 ppm, but bulk product (40 CFR 761.62, "Disposal of PCB Bulk Product Waste") and remediation waste (40 CFR 761.61, "PCB Remediation Waste") concentrations are not limited.

Polychlorinated biphenyl bulk product waste is derived from manufactured products containing PCBs in a nonliquid state at any concentration where the concentration at the time of designation for disposal was ≥ 50 ppm PCBs. Polychlorinated biphenyl bulk product waste does not include PCBs or PCB items regulated for disposal under 40 CFR 761.60(a) through (c), "Disposal Requirements"; 40 CFR 761.61, "Remediation Waste"; 40 CFR 761.63, "PCB Household Waste Storage and Disposal"; or 40 CFR 761.64, "Disposal of Wastes Generated as a Result of Research and Development Activities Authorized Under § 761.30(j) and Chemical Analysis of PCBs." Polychlorinated biphenyl bulk product waste includes but is not limited to:

- Nonliquid bulk waste or debris from the demolition of buildings and other man-made structures manufactured, coated, or serviced with PCBs. Polychlorinated biphenyl bulk product waste does not include debris from the demolition of buildings or other man-made structures that are contaminated by spills from regulated PCBs that have not been disposed of, decontaminated, or otherwise cleaned up in accordance with Subpart D of 40 CFR 761.62, "Disposal of PCB Bulk Product Waste."
- PCB-containing waste from the shredding of automobiles, household appliances, or industrial appliances.
- Plastics (e.g., plastic insulation from wire or cable, radio, television and computer casings, vehicle parts, or furniture laminates); preformed or molded rubber parts and components; applied dried paints, varnishes, waxes or other similar coatings or sealants; caulking; adhesives; paper; Galbestos; sound-deadening or other types of insulation; and felt or fabric products such as gaskets.
- Fluorescent light ballasts containing PCBs in the potting material.

Polychlorinated biphenyl remediation waste, including PCB sewage sludge, is regulated for cleanup and disposal in accordance with 40 CFR 761.61. Polychlorinated biphenyl remediation waste contains PCBs as a result of a spill, release, or other unauthorized disposal at the following concentrations: (1) materials disposed of before April 18, 1978, that are currently at concentrations ≥ 50 ppm PCBs regardless of the concentration of the original spill; (2) materials that are currently at any volume or concentration where the original source was ≥ 500 ppm PCBs beginning on April 18, 1978, or ≥ 50 ppm PCBs beginning on July 2, 1979; and (3) materials that are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under 40 CFR 761.61.

Polychlorinated biphenyl remediation waste is soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not limited to:

- Environmental media containing PCBs (e.g., soil and gravel); dredged materials (e.g., sediments, settled sediment fines, and aqueous decantate from sediment).
- Sewage sludge containing < 50 ppm PCBs and not in use according to 40 CFR 761.20(a)(4), “Prohibitions and Exceptions”; PCB sewage sludge; commercial or industrial sludge contaminated as the result of a PCB spill including sludge located in or removed from any pollution control device; and aqueous decantate from an industrial sludge.
- Buildings and other man-made structures (e.g., concrete floors, wood floors, or walls contaminated from a leaking PCB or PCB-contaminated transformer); porous surfaces; and nonporous surfaces.

Waste containing greater than 1% chelating compounds cannot be placed in the ICDF landfill (DOE Order 435.1).

2.6.2.4 Inorganics/Other. There are no ARAR-based limitations on inorganic contents in the waste from inside the AOC (LDRs do not apply). However, WAC risk-based concentration and mass limits do apply.

2.6.2.5 Radionuclides. The ROD (DOE-ID 1999) and DOE Order 435.1 invoke regulatory limits on radionuclide activity that can be disposed of at the ICDF landfill, as discussed below.

Because the ROD restriction is based on TRU isotopes, the 10 nCi/g for the waste acceptance criteria was calculated as follows. The alpha-emitting TRU isotopes with half-lives greater than 20 years are Np-237, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Am-241, Am-243, Cm-243, Cm-245, Cm-246, Cm-248, Cm-250, Bk-247, Cf-249, and Cf-251. These isotopes may be present in unequal amounts; the sum of all TRU isotopes must total less than 10 nCi/g for the entire waste stream.

The Nuclear Regulatory Commission performance-based disposal requirement (10 CFR 61, “Licensing Requirements for Land Disposal of Radioactive Waste”) is paralleled by DOE Order 435.1 and includes radiological waste classification. Waste greater than Class C waste cannot be disposed of at the ICDF landfill.

2.7 Development of Numerical Waste Acceptance Criteria

For waste within the AOC, the waste acceptance criteria for each hazardous constituent and radionuclide were calculated based on the RAOs identified in the ROD (DOE-ID 1999).

2.8 Tracking Waste Acceptance Criteria During Operations

The waste acceptance criteria presented herein have been developed based on data regarding the proposed design inventory, achieving RAOs, liner compatibility, and regulatory requirements. On a RAO basis, the waste acceptance criteria have been developed by assuming that all contaminants are present in the entire volume of the landfill (510,000 yd³). The liner compatibility criteria are based on individual constituent limits and/or on a total maximum concentration by chemical category (i.e., 500,000 ppm for total organics). Actual waste entering the landfill will have different contaminant concentrations from the assumptions made in the waste acceptance criteria. Periodic evaluation will be necessary to track the actual contaminants entering the landfill for comparison against RAO, liner compatibility, or other regulatory limits.

The following methodology is provided as one method of tracking receipt of actual waste contaminants and contaminant masses versus the proposed waste acceptance criteria:

- Each waste load or container will have a waste container profile identifying the substances and concentrations contained in the waste. The container profiles have the total mass not the concentrations. Also, the Waste Accounting and Information Reporting System (WAIRS) tracks waste as shipments not containers. This waste container profile may be the same as the waste profile but will not exceed the concentrations in the waste profile.
- The mass of each constituent placed in the landfill will be calculated for each waste load or container using the information from the waste container profile (weight × concentration for each constituent).
- A database or spreadsheet will be kept identifying each constituent and the cumulative mass of each constituent placed in the landfill.
- A running inventory will be maintained of the total mass of each constituent received at the facility. The total mass received for each substance will be compared to the total mass limit of the substance identified in the waste acceptance criteria. This comparison for each substance will provide an indication of how much of the waste acceptance criteria limit has been used by the actual substances in the waste. In addition, average concentrations of the constituents in each container or waste load will be checked against concentration-based criteria.

As the waste is placed in the landfill, the tracking system will record the cumulative total of each substance mass. If waste concentrations are significantly lower than the waste acceptance criteria limits, then the concentration guidelines can be increased without affecting the total mass limits in the waste acceptance criteria. Any changes in the waste acceptance criteria concentration guidelines will be recorded in a revision to this document and will follow the requirements for revisions to the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991) primary document. The waste tracking system will be described in the *INEEL CERCLA Disposal Facility Complex Remedial Action Work Plan* (DOE-ID 2003b).

3. ACCEPTANCE CRITERIA FOR THE ICDF LANDFILL

3.1 Prohibited Waste

The types of waste that are prohibited from disposal in the ICDF landfill are described in this section. The quality assurance program will include a determination that no prohibited waste is accepted for disposal at the ICDF landfill.

3.1.1 Waste with >10 nCi/g Transuranic Constituents

Waste containing greater than 10 nCi/g of TRU radionuclides is prohibited from disposal at the ICDF landfill in accordance with the ROD (Appendix A, “Operable Unit 3-13 Responsiveness Summary, Public Comments and Responses on the OU 3-13 Proposed Plan,” responses to comments #28, 226, and 230 [DOE-ID 1999]).

3.1.2 Toxic Substances Control Act Waste Containing >500 ppm Polychlorinated Biphenyls

Soil waste containing greater than 500 ppm of PCBs is prohibited from disposal at the ICDF landfill; however, bulk product and remediation waste PCB concentrations are not limited. No soil waste greater than 500 ppm of PCBs is expected, based on the inventory described in EDF-ER-264, “INEEL CERCLA Disposal Facility Design Inventory.”

3.1.3 Free Liquids

Waste containing free liquids is prohibited from disposal at the ICDF landfill, unless the liquids have been stabilized. If necessary, the presence of free liquids shall be determined by U.S. Environmental Protection Agency (EPA) Method 9095, “Paint Filter Liquids Test,” (EPA 2002) or the free liquid procedure in *ICDF Complex Operations and Maintenance* (DOE-ID-2003c) before shipment to the ICDF Complex.

3.1.4 Waste Capable of Detonation, Explosive Decomposition, or Reaction

Waste capable of detonation or explosive decomposition is prohibited. This includes ordnance and explosive materials that could be encountered during excavation of waste. Generally, process knowledge will be used to make the determination that a waste is or is not capable of detonation or explosive decomposition, based on unexploded observable ordnance. If it is not clear based on process knowledge, specific testing of the waste could be required.

3.1.5 Waste Capable of Generating Toxic Gases, Vapors, or Fumes

Waste capable of generating toxic gases, vapors, or fumes harmful to persons transporting, handling, and disposing of the waste (DOE Manual 435.1) is prohibited. The only allowable types of degradable waste are wood, building demolition debris, PPE, and metals. Toxic gases are not formed from the degradation of these materials.

3.1.6 Gaseous Waste

All gaseous waste containers must be empty and flattened.

3.1.7 Waste Exceeding the Class C Limit

Waste exceeding the Class C radioactive waste limit is prohibited, as defined in 10 CFR 61.55, “Waste Classification.”

3.1.8 Waste Containing Greater than 1% Chelating Compounds by Weight

Waste containing greater than 1% chelating compounds by weight is prohibited. Chelating compounds can mobilize constituents and cause the RAOs to be exceeded. Examples of chelating compounds are glycinate, salicylate, chelidamic acid, and phthalic acid.

3.1.9 Spent Nuclear Fuel and High-Level Waste

Spent nuclear fuel and high-level waste (DOE Manual 435.1) are prohibited.

3.2 Restricted Types of Waste Requiring Treatment

Table 3-1 lists the materials restricted from disposal at the ICDF landfill until specific conditions are met.

Table 3-1. Treatment requirements for ICDF landfill restricted waste.

Restricted Material	Condition to be Met
Hazardous waste outside the AOC	Hazardous waste from outside the AOC must be treated to meet UTSs for those constituents reasonably expected to be present.
Bulk disposal of waste containing free liquids	Free liquids must be eliminated by stabilization (adding materials to chemically immobilize the free liquids in the waste). If necessary, the presence of free liquids shall be determined by EPA Method 9095 (“Paint Filter Liquids Test”) (EPA 2002) before shipment to the ICDF Complex.
Containerized waste holding free liquids, unless one of the following conditions has been met:	All freestanding liquid has been decanted, solidified with nonbiodegradable sorbent materials, stabilized, or otherwise eliminated. ^a The waste has been converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable. In no case shall the liquid exceed 1% of the waste volume in a disposal container or 0.5% of the waste volume processed to a stable form. ^a
LDR—Restricted waste	Must meet LDR requirements for 40 CFR 268.
Refrigerant-bearing equipment containing CFCs	The CFC removal has been completed (40 CFR 82).
Pyrophoric waste	The waste must be treated, prepared, and packaged to be nonflammable before being disposed of.

Table 3-1. (continued).

Restricted Material	Condition to be Met
Infectious waste, as defined in 29 CFR 1910.1030, "Bloodborne Pathogens" (including "any substance that may harbor or transmit pathogenic organisms," which may apply to septic tank sludge)	Special handling procedures will be developed.
pH <2 or >12.5	Neutralized
TNT RDX	The waste must not be capable of detonation, explosive decomposition, or reaction at normal pressures and temperature, or explosive reaction with water.

a. The procedure for determining free liquids is provided in *ICDF Complex Operations and Maintenance* (DOE-ID 2003c).

AOC = area of contamination

CFC = chlorofluorocarbon

CFR = *Code of Federal Regulations*

EPA = U.S. Environmental Protection Agency

ICDF = INEEL CERCLA Disposal Facility

LDR = land disposal restriction

RDX = Royal Demolition Explosive

TNT = trinitrotoluene

UTS = Universal Treatment Standard

3.3 Physical and Chemical Criteria

3.3.1 Liquid and Liquid-Containing Waste

For liquid-containing waste where condensate could form in inner plastic packaging (e.g., bags) subsequent to packaging, the condensate shall be eliminated to the maximum extent practical by placing sorbents within the inner plastic packaging. In any case, the amount of liquid may not exceed 1% of the waste volume or 0.5% of waste processed to a stable form.

Residual liquids in large debris items shall be sorbed or removed. In cases where removing suspected liquids is not practical and sampling to determine if liquids are present is impossible, the liquids shall be removed to the maximum extent possible by draining suspected liquids at low points and placing an adequate amount of sorbent around each item. In any case, the amount of liquid cannot exceed 1% of the waste volume.

3.3.2 Land Disposal Restrictions

The application of LDRs for waste that is either a listed waste and/or characteristic waste depends on whether a waste originates from inside the WAG 3 AOC or has triggered placement.

Waste originating inside the WAG 3 AOC (that has not triggered placement) is acceptable for direct disposal in the ICDF landfill without the need to meet the RCRA LDRs specified in the ROD (DOE-ID 1999), provided that the waste meets the appropriate waste acceptance criteria.

3.3.3 Solidification or Stabilization of Organic Liquids and Chelating Compounds

Organic liquids and chelating compounds exceeding 1% of the waste by weight must be solidified or stabilized to a form that immobilizes the organic and chelating compounds.

3.3.4 Asbestos-Containing Waste

Asbestos-containing waste should be sent to the Central Facilities Area bulk landfill unless the radionuclide content of the waste prevents this disposal. If the waste is radioactive, asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150, "National Emission Standard for Asbestos." Wetting with water is allowed as long as it does not exceed applicable free liquid requirements. Asbestos waste will be disposed of in accordance with applicable state and federal regulations.

3.3.5 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per m³ (0.1 watt per ft³), then the package must be evaluated using conversion factors to ensure that the heat does not affect the integrity of the container or surrounding containers in the ICDF landfill. This evaluation must be provided to and approved by the ICDF Complex operations manager.

3.3.6 Gas Generation

Gas generation from radiolytic or biological decomposition of containerized waste must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kilopascals absolute pressure) and combustible gas (e.g., hydrogen and methane) concentrations exceeding the lower explosive limit during handling before disposal. Field methods for determining presence and amount of combustible gas can be used to demonstrate compliance with these criteria.

3.3.7 Physical Limits

Physical requirements may influence the disposal of certain waste types to the ICDF landfill, even when the waste satisfies other ICDF landfill waste acceptance criteria. Physical waste characteristics such as weight, volume, dimensions, or length might require adjustment before the waste is accepted for disposal. Table 3-2 identifies the physical limits and restrictions that must be met before the waste types will be considered for disposal at the ICDF landfill.

Table 3-2. Physical limits for ICDF landfill proposed waste.

Waste Type	Limits and Restrictions
Steel boxes	Steel boxes are assumed to be completely filled and, therefore, incompressible. Steel boxes with greater than 5% void space will not be accepted.
Concrete debris	Concrete may be sent to the ICDF in one of two different forms. Reduced to rubble with a maximum dimension of approximately 1 ft. It is preferred that this rubble be mixed with other waste soil so that it can be handled as soil at the ICDF. Large blocks or slabs may be shipped under the following criteria: <u>Containerized:</u> It must not exceed the gross weight limit for the container. It must not extend above the sidewalls of the container. It shall not exceed 20 ft in length unless specifically approved by ICDF operations and must be loaded toward the rear of the box. All rebar must be cut as close as practical to the surface. <u>Noncontainerized:</u> It shall not exceed 20 ft in length unless specifically approved by ICDF operations. If greater than 8 ft in any dimension, or large rubble is provided, consideration shall be given to grouting in place to ensure that compaction is achieved. All rebar must be cut as close as practical to the surface of slabs and rubble.

Table 3-2. (continued).

Waste Type	Limits and Restrictions
Steel plate	Steel plate shall not exceed 4 ft in width or 8 ft in length unless specifically approved by ICDF operations. To minimize voids, steel plate shall not be bent or folded.
Rebar	Rebar should be cut to lengths of approximately 8 ft or less and mixed with soil to the extent practical. Rebar pieces where soil is not common can be placed in bulk roll-off containers with other hard debris.
Other debris-like material	Other debris-like material that exceeds the dimensions above may be disposed of subject to approval of a placement plan that addresses compliance with placement and compaction requirements (e.g., grout in place, fill voids with grout).
ICDF = INEEL CERCLA Disposal Facility.	

3.4 Radiological Criteria

3.4.1 Radiological Inventory Limits

The radiological inventory limits for the ICDF landfill will be maintained to stay within the facility safety envelope and authorization basis. These inventory limits are to be less than a Hazard Category 3 Nuclear Facility.

3.4.2 Criticality Safety Limits

Criticality safety limits are described in Section 5.4.3 of the *ICDF Complex Waste Acceptance Criteria* (DOE-ID 2003a), Table 1-1.

3.4.3 Package External Concentration Limits

Package external concentration limits are described in Section 5.4.4 of the *ICDF Complex Waste Acceptance Criteria* (DOE-ID 2003a), Table 1-1.

3.4.4 Package Dose Rate Limits

Package dose rate limits are described in Section 5.4.5 of the *ICDF Complex Waste Acceptance Criteria* (DOE-ID 2003a), Table 1-1.

3.4.5 Noncontact-Handled Waste

Non-contact-handled waste shall meet the applicable dose rate restrictions of the U.S. Department of Transportation or an approved packaging safety analysis. Remote-handled waste shall be configured for unloading such that personnel exposures are maintained as low as reasonably achievable.

3.4.6 Minimizing Subsidence

All waste shall be packaged in a form that minimizes settling and subsidence of the ICDF landfill to the maximum extent feasible. The following forms will be considered to meet these criteria:

- Inherently stable waste that will not subside in the disposal environment
- Waste stabilized by grouting or packaging
- Containerized soil and soil-like solids and sorbed liquids that fill at least 95% of the volume of the container

- Other containerized waste that fills at least 95% of the internal volume of the container; void space should be kept to a minimum
- Any void fillers must be selected and used in accordance with the requirements of these waste acceptance criteria.

3.5 Numerical Criteria

The chemical limits for waste from within the WAG 3 AOC that have not triggered placement and radiological waste acceptance criteria limits are shown in Table 3-3.

Table 3-3. The ICDF landfill waste acceptance criteria.

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
<i>Organics</i>			
1,1,1-Trichloroethane	1.6E+01	1.2E+04	RAO
1,1,2,2-Tetrachloroethane	5.0E-02	3.8E+01	RAO
1,1,2-Trichloroethane	2.4E-01	1.8E+02	RAO
1,1-Dichloroethane	2.3E+00	1.8E+03	RAO
1,1-Dichloroethene	1.5E+00	1.1E+03	RAO
1,2,3,4,6,7,8,9-OCDD	6.9E+01	5.2E+04	RAO
1,2,3,4,6,7,8,9-OCDF	1.4E+01	1.1E+04	RAO
1,2,3,4,6,7,8-HpCDD	4.6E+01	3.5E+04	RAO
1,2,3,4,6,7,8-HpCDF	1.2E+02	9.1E+04	RAO
1,2,3,4,7,8,9-HpCDF	5.9E-01	4.4E+02	RAO
1,2,3,4,7,8-HxCDD	1.1E-01	8.3E+01	RAO
1,2,3,4,7,8-HxCDF	2.0E+02	1.5E+05	RAO
1,2,3,6,7,8-HxCDD	8.4E-01	6.4E+02	RAO
1,2,3,6,7,8-HxCDF	1.0E+01	7.7E+03	RAO
1,2,3,7,8,9-HxCDD	2.4E+00	1.8E+03	RAO
1,2,3,7,8,9-HxCDF	2.2E-02	1.7E+01	RAO
1,2,3,7,8-PeCDD	1.1E-01	8.0E+01	RAO
1,2,3,7,8-PeCDF	9.3E-01	7.1E+02	RAO
1,2,4-Trichlorobenzene	1.1E+01	8.7E+03	RAO
1,2-Dichlorobenzene	1.1E+01	8.7E+03	RAO
1,2-Dichloroethane	5.0E-02	3.8E+05	Regulatory limit
1,2-Dichloroethene (total)	3.2E-01	2.5E+02	RAO
1,3-Dichlorobenzene	1.1E+01	8.7E+03	RAO
1,4-Dichlorobenzene	4.4E+01	3.2E+04	Regulatory limit
1,4-Dioxane	1.9E-02	1.4E+01	RAO
2,3,4,6,7,8-HxCDF	1.6E+01	1.2E+04	RAO

Table 3-3. (continued).

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
2,3,4,7,8-PeCDF	6.3E+00	4.8E+03	RAO
2,3,7,8-TCDD	4.1E-03	3.1E+00	RAO
2,3,7,8-TCDF	5.5E+01	4.2E+04	RAO
2,4,5-Trichlorophenol	4.5E+01	3.4E+04	RAO
2,4,6-Trichlorophenol	1.8E+01	1.4E+04	RAO
2,4-Dichlorophenol	2.2E+01	1.6E+04	RAO
2,4-Dimethylphenol	1.8E+01	1.4E+04	RAO
2,4-Dinitrophenol	5.1E+01	3.9E+04	RAO
2,4-Dinitrotoluene	1.1E+01	8.7E+03	RAO
2,6-Dinitrotoluene	2.1E+01	1.6E+04	RAO
2-Butanone	2.5E+01	1.9E+04	RAO
2-Chloronaphthalene	1.1E+01	8.7E+03	RAO
2-Chlorophenol	1.8E+01	1.4E+04	RAO
2-Hexanone	2.7E+00	2.0E+03	RAO
2-Methylnaphthalene	5.1E+02	3.9E+05	RAO
2-Methylphenol	2.1E+01	1.6E+04	RAO
2-Nitroaniline	3.4E+03	2.6E+06	RAO
2-Nitrophenol	1.8E+01	1.4E+04	RAO
3,3-Dichlorobenzidine	1.1E+01	8.7E+03	RAO
3-Methyl butanol	3.3E+04	2.5E+07	Liner compatibility
3-Nitroaniline	3.4E+03	2.6E+06	RAO
4,6-Dinitro-2-methylphenol	4.5E+01	3.4E+04	RAO
4-Bromophenyl-phenylether	8.5E+04	6.5E+07	Liner compatibility
4-Chloro-3-methylphenol	9.6E+04	7.3E+07	Liner compatibility
4-Chloroaniline	4.1E+01	3.1E+04	RAO
4-Chlorophenyl-phenylether	1.0E+05	7.6E+07	Regulatory limit
4-Methyl-2-pentanone	3.0E+01	2.2E+04	RAO
4-Methylphenol	3.9E+01	2.9E+04	RAO
4-Nitroaniline	3.4E+03	2.6E+06	RAO
4-Nitrophenol	5.2E+01	3.9E+04	RAO
Acenaphthene	2.0E+02	1.5E+05	RAO
Acenaphthylene	2.1E+01	1.6E+04	RAO
Acetone	4.9E+01	3.7E+04	Regulatory limit
Acetonitrile	1.2E+00	8.8E+02	RAO
Acrolein	5.5E-01	4.2E+02	RAO
Acrylonitrile	5.8E-01	4.4E+02	RAO
Anthracene	3.2E+02	2.4E+05	RAO

Table 3-3. (continued).

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
Aramite	6.7E+00	5.1E+03	RAO
Aroclor-1016	7.7E+00	5.8E+03	RAO
Aroclor-1254	1.3E+02	9.7E+04	RAO
Aroclor-1260	5.0E+02	3.8E+05	Regulatory limit
Aroclor-1262	5.0E+02	3.8E+05	Regulatory limit
Aroclor-1268	6.2E+01	4.7E+04	RAO
Benzene	2.2E+02	1.7E+05	Regulatory limit
Benzidine	1.7E+01	1.3E+04	RAO
Benzo(a)anthracene	2.5E+02	1.9E+05	RAO
Benzo(a)pyrene	1.1E+02	8.0E+04	RAO
Benzo(b)fluoranthene	1.8E+02	1.4E+05	RAO
Benzo(g,h,i)perylene	1.1E+01	8.7E+03	RAO
Benzo(k)fluoranthene	1.9E+01	1.4E+04	RAO
Benzoic acid	8.6E+00	6.5E+03	RAO
bis(2-Chloroethoxy)methane	1.6E+02	1.2E+05	Liner compatibility
bis(2-Chloroethyl)ether	1.1E+01	8.7E+03	RAO
bis(2-Chloroisopropyl)ether	1.1E+01	8.7E+03	RAO
bis(2-Ethylhexyl)phthalate	1.5E+02	1.1E+05	RAO
Bromomethane	5.0E+02	3.8E+05	Regulatory limit
Butane, 1,1,3,4-tetrachloro	1.0E+05	7.6E+07	Regulatory limit
Butylbenzylphthalate	6.8E+01	5.2E+04	RAO
Carbazole	3.2E+01	2.5E+04	RAO
Carbon disulfide	4.6E+01	3.5E+04	RAO
Chlorobenzene	6.6E+00	5.0E+03	RAO
Chloroethane	1.5E-01	1.1E+02	RAO
Chloromethane	3.5E-01	2.7E+02	RAO
Chrysene	2.7E+02	2.0E+05	RAO
Decane, 3,4-dimethyl	3.3E+04	2.5E+07	Liner compatibility
Diacetone alcohol	1.0E+05	7.6E+07	Regulatory limit
Dibenz(a,h)anthracene	1.1E+01	8.7E+03	RAO
Dibenzofuran	3.2E+02	2.5E+05	RAO
Dichlorodifluoromethane	4.0E+02	3.0E+05	Liner compatibility
Diethylphthalate	1.1E+01	8.7E+03	RAO
Dimethyl disulfide	3.3E+04	2.5E+07	Liner compatibility
Dimethylphthalate	1.1E+01	8.7E+03	RAO
Di-n-butylphthalate	2.4E+01	1.8E+04	RAO
Di-n-octylphthalate	2.6E+01	2.0E+04	RAO

Table 3-3. (continued).

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
Eicosane	1.0E+05	7.6E+07	Regulatory limit
Ethyl cyanide	3.3E+04	2.5E+07	Liner compatibility
Ethylbenzene	7.8E+01	5.9E+04	RAO
Famphur	1.0E+05	7.6E+07	Regulatory limit
Fluoranthene	7.6E+02	5.8E+05	RAO
Fluorine	1.8E+02	1.4E+05	RAO
Heptadecane, 2,6,10,15-tetra	3.3E+04	2.5E+07	Liner compatibility
Hexachlorobenzene	1.1E+01	8.7E+03	RAO
Hexachlorobutadiene	2.1E+01	1.6E+04	RAO
Hexachlorocyclopentadiene	1.1E+01	8.7E+03	RAO
Hexachloroethane	1.1E+01	8.7E+03	RAO
Indeno(1,2,3-cd)pyrene	1.1E+01	8.7E+03	RAO
Isobutyl alcohol	1.2E+00	8.8E+02	RAO
Isophorone	1.1E+01	8.7E+03	RAO
Isopropyl alcohol/2-propanol	1.0E+05	7.6E+07	Regulatory limit
Kepone	9.9E+01	7.5E+04	RAO
Mesityl oxide	1.0E+05	7.6E+07	Regulatory limit
Methyl acetate	4.8E-01	3.7E+02	RAO
Methylene chloride	2.7E+01	2.1E+04	Liner compatibility
Naphthalene	4.3E+02	3.2E+05	RAO
Nitrobenzene	1.1E+01	8.7E+03	RAO
N-Nitroso-di-n-propylamine	1.1E+01	8.7E+03	RAO
N-Nitrosodiphenylamine	1.1E+01	8.7E+03	RAO
Octane,2,3,7-trimethyl	3.3E+04	2.5E+07	Liner compatibility
o-Toluenesulfonamide	3.3E+04	2.5E+07	Liner compatibility
Pentachlorophenol	5.6E+01	4.2E+04	RAO
Phenanthrene	1.2E+03	8.9E+05	RAO
Phenol	8.0E+01	6.1E+04	RAO
Phenol,2,6-bis(1,1-dimethyl)	1.0E+05	7.6E+07	Regulatory limit
Polyvinyl Chloride	1.0E+05	7.6E+07	Regulatory limit
p-Toluenesulfonamide	3.3E+04	2.5E+07	Liner compatibility
Pyrene	2.5E+02	1.9E+05	RAO
RDX	1.0E+01	7.9E+03	RAO
Styrene	5.0E+02	3.8E+05	Regulatory limit
Tetrachloroethene	9.6E+00	7.3E+03	RAO
Toluene	3.0E+01	2.2E+04	Regulatory limit
Tributylphosphate	4.8E+02	3.6E+05	Liner compatibility

Table 3-3. (continued).

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
Trichloroethene	3.1E+01	2.3E+04	Regulatory limit
Trinitrotoluene	1.1E+01	8.4E+03	RAO
Undecane, 4,6-dimethyl	3.3E+02	2.5E+05	Liner compatibility
Vinyl Chloride	2.5E+02	1.9E+05	Liner compatibility
Xylene (ortho)	3.9E+00	2.9E+03	RAO
Xylene (total)	2.8E+02	2.1E+05	Regulatory limit
<i>Inorganics</i>			
Aluminum	1.6E+05	1.2E+08	10 × background
Antimony	5.8E+03	4.4E+06	RAO
Arsenic	5.8E+01	4.4E+04	RAO
Barium	3.0E+03	2.3E+06	RAO
Beryllium	1.8E+01	1.4E+04	RAO
Boron	3.3E+03	2.5E+06	RAO
Bromide	3.3E+04	2.5E+07	Liner Compatibility
Cadmium	3.6E+03	2.7E+06	RAO
Calcium	No limit	No limit	Liner compatibility
Chloride	3.3E+04	2.5E+07	Liner compatibility
Chromium	4.1E+04	3.1E+07	RAO
Cobalt	1.1E+02	8.3E+04	RAO
Copper	3.0E+04	2.3E+07	RAO
Cyanide	3.4E+02	2.6E+05	RAO
Dysprosium	5.9E+04	4.5E+07	RAO
Fluoride	3.9E+03	2.9E+06	RAO
Iron	2.4E+05	1.8E+08	10 × background
Lead	5.8E+04	4.4E+07	RAO
Magnesium	1.2E+05	9.1E+07	10 × background
Manganese	4.9E+03	3.7E+06	RAO
Mercury	9.5E+03	7.2E+06	RAO
Molybdenum	1.0E+04	7.7E+06	RAO
Nickel	3.5E+02	2.7E+05	RAO
Nitrate	3.9E+03	3.0E+06	RAO
Nitrate/Nitrite-N	3.3E+04	2.5E+07	Liner compatibility
Nitrite	8.5E+00	6.4E+03	RAO
Phosphate	3.3E+04	2.5E+07	Liner Compatibility
Phosphorus	No limit	No limit	Liner compatibility
Potassium	4.3E+04	3.3E+07	10 × background
Selenium	8.5E+02	6.4E+05	RAO

Table 3-3. (continued).

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
Silicon	3.3E+04	2.5E+07	Liner Compatibility
Silver	9.8E+03	7.5E+06	RAO
Sodium	3.2E+03	2.4E+06	10 × background
Strontium	1.8E+04	1.4E+07	RAO
Sulfate	3.3E+04	2.5E+07	Liner compatibility
Sulfide	3.3E+04	2.5E+07	Liner compatibility
Terbium	No limit	No limit	Liner compatibility
Thallium	4.3E+00	3.3E+03	RAO
Tin	3.0E+03	2.3E+06	RAO
Vanadium	4.5E+02	3.4E+05	RAO
Ytterbium	No limit	No limit	Liner compatibility
Zinc	2.1E+05	1.6E+08	RAO
Zirconium	No limit	No limit	Liner compatibility
<i>Radionuclides</i>			
Ag108m	8.0E+05	6.1E+02	RAO
Am241	1.0E+07	7.6E+03	Regulatory limit
Am243	3.3E+02	2.5E-01	RAO
Ba137m	No limit	No limit	Liner compatibility
C14	3.0E+03	2.3E-00	RAO
Cd113m	1.6E+06	1.2E+03	RAO
Ce144	1.8E+03	1.4E+00	RAO
Co57	3.7E+03	2.8E+00	RAO
Co60	1.9E+08	1.5E+05	RAO
Cs134	1.1E+07	8.5E+03	RAO
Cs137	2.3E+12	1.7E+09	Regulatory limit
Eu152	9.7E+08	7.3E+05	RAO
Eu154	8.2E+08	6.2E+05	RAO
Eu155	1.8E+08	1.3E+05	RAO
Fe55	2.0E+12	1.5E+09	RAO
H3	5.0E+07	3.8E+04	RAO
I129	3.1E+03	2.4E+00	RAO
K40	2.4E+05	1.8E+02	RAO
Kr85	No limit	—	RAO
Ni59	9.5E+09	7.2E+06	RAO
Ni63	6.0E+10	4.6E+07	RAO
Np237	6.4E+05	4.9E+02	RAO
Pm147	3.8E+08	2.9E+05	RAO

Table 3-3. (continued).

Constituent ^a	Selected Waste Acceptance Criteria Concentration Guideline (mg/kg or pCi/kg)	Landfill Waste Acceptance Criteria Maximum Mass (kg or Ci)	Source of Waste Acceptance Criteria Concentration Guideline
Pu238	1.0E+07	7.6E+03	Regulatory limit
Pu239	6.7E+06	5.1E+03	RAO
Pu240	1.5E+06	1.1E+03	RAO
Pu241	6.4E+07	4.9E+04	RAO
Ra226	4.7E+05	3.6E+02	RAO
Ru106	1.2E+04	9.2E+00	RAO
Sb125	9.3E+06	7.0E+03	RAO
Sm151	3.4E+08	2.6E+05	RAO
Sr90	3.5E+12	2.7E+09	Regulatory limit
Tc99	5.8E+06	4.4E+03	RAO
Te125m	2.3E+06	1.7E+03	RAO
Th228	1.6E+04	1.2E+01	RAO
Th230	1.4E+04	1.1E+01	RAO
Th232	1.7E+04	1.3E+01	RAO
U233	1.6E+08	1.2E+05	Liner compatibility
U234	6.0E+06	2.6E+03	RAO
U235	1.1E+05	8.3E+01	RAO
U236	2.0E+05	1.5E+02	RAO
U238	2.0E+06	1.5E+03	RAO
Y90	2.3E+10	1.7E+07	RAO

a. The mass values are maximum masses that cannot be exceeded.

RAO = remedial action objective

3.6 Packaging Criteria

Packaging criteria are described in Section 5.5 of the *ICDF Complex Waste Acceptance Criteria* (DOE-ID 2003a), see Table 1-1.

4. REFERENCES

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Appendix A

Remedial Action Objective Criteria

Appendix A

Remedial Action Objective Criteria

A-1. PURPOSE

The purpose of this appendix is to define the allowable waste soil constituent concentrations (i.e., criteria) based on the Remedial Action Objectives (RAOs) defined in the *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 1999), hereinafter referred to as the ROD. These criteria will be compared with other concentration-based criteria to support the ultimate waste acceptance criteria (WAC) definition.

A-2. REQUIREMENTS OR GIVENS

A-2.1 Design Inventory

The design inventory constituents and associated site-specific concentrations are published in the *INEEL CERCLA Disposal Facility Design Inventory* (EDF-ER-264). All constituents identified in the design inventory will be considered in this evaluation. The design inventory concentrations (C_{DI}) provide the starting point for evaluating the RAOs and determining acceptable concentrations.

A-2.2 Remedial Action Objective

The RAO provides the basis for calculating the required concentration-based criteria. The RAOs specific to the INEEL CERCLA Disposal Facility (ICDF) is stated in the Operable Unit 3-13 ROD (DOE-ID 1999, page 8-2) as:

Maintain caps placed over contaminated soil or debris areas that are contained in place and the closed ICDF-complex, to prevent the release of leachate to underlying groundwater which would result in exceeding a cumulative carcinogenic risk of $1E-4$, a total HI of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs) in the SRPA.

This RAO provides the basis for developing three criteria:

- Cumulative excess lifetime carcinogenic risk (ELCR) in groundwater of $1E-4$
- Total noncarcinogenic hazard index (HI) in groundwater of 1
- Achieving the maximum contaminant levels (MCLs) in groundwater (e.g., individual constituents, total alpha of 15 pCi/L).

A-2.3 Design Inventory Evaluation

The analysis of the design inventory constituents and concentrations over time is performed in conjunction with the fate and transport modeling. The results of this evaluation indicate that the RAOs are not exceeded in the $1.0E+06$ year simulation period. A detailed discussion of the method and approach of this evaluation is provided in the modeling document (EDF-ER-274, "Leachate Contaminant Reduction Time Study").

A-3. METHODOLOGY AND IMPLEMENTATION

Since the fate and transport modeling indicates that the C_{DI} is well within acceptable limits, constituent concentrations are adjusted to maximize WAC limits. The purpose of these adjustments is to increase the concentrations such that the RAOs are approached, but not exceeded. The initial concentration adjustments are based on an overall increase in C_{DI} concentrations. These concentration adjustments were to add a margin of safety between the design inventory and WAC limits.

The initial adjustments are based on the following rationale, in order of the application:

- Initially, all constituents are reviewed to determine if there are risk factors or MCL elements that warrant setting a RAO limit. If none are identified, the criteria adjusted value is set to “No Limit” and the basis is explained as “No Limits.”
- Background is included in the evaluation for constituents with background concentrations. When the background concentration exceeds the C_{DI} , the value is adjusted to $10 \times$ background and the basis is explained as “ $10 \times$ Background.” The existing background concentrations in the Snake River Plain Aquifer (SRPA) were also reviewed and combined with predicted peak groundwater concentrations (at the design infiltration rate of 0.0001 m/yr) and compared to the MCL.
- The $10 \times$ value is consistent with the Remedial Investigation/Baseline Risk Assessment for Waste Area Group (WAG) 3 at the INEEL. This approach eliminates contaminations as a concern if the exposure point concentration was less than $10 \times$ the background value.
- Constituents with a C_{DI} less than $1.0E-10$, including those with a concentration of zero, are assigned a minimum adjusted concentration of $1.0E-10$ irrespective of units, and basis is explained as “Minimum Concentration.”
- All other C_{DI} s are increased by three orders of magnitude (i.e., a factor of 1,000), and basis is explained as “Cumulative Groundwater RBC.”
- All constituents that are less than the maximum concentration detected in historical data are modified to exceed the concentration, and basis is explained as “Adjusted to exceed maximum concentrations.”

These initial concentration adjustments result in three specific types of exceedence. These specific areas, and primary contributor(s), include the following:

- An unacceptable HI due to 2-, 3-, and 4-nitroanilines
- An unacceptable ELCR due to I-129
- An unacceptable MCL comparison, specific to the beta particles and photon emitters criterion, due to I-129.

The constituent concentrations for the primary contributors are adjusted downward until all RAOs reach acceptable limits. The resultant evaluation provides RAO-based criteria that are protective. Representative adjusted RAO curves are provided in Figures A-1 through A-3.

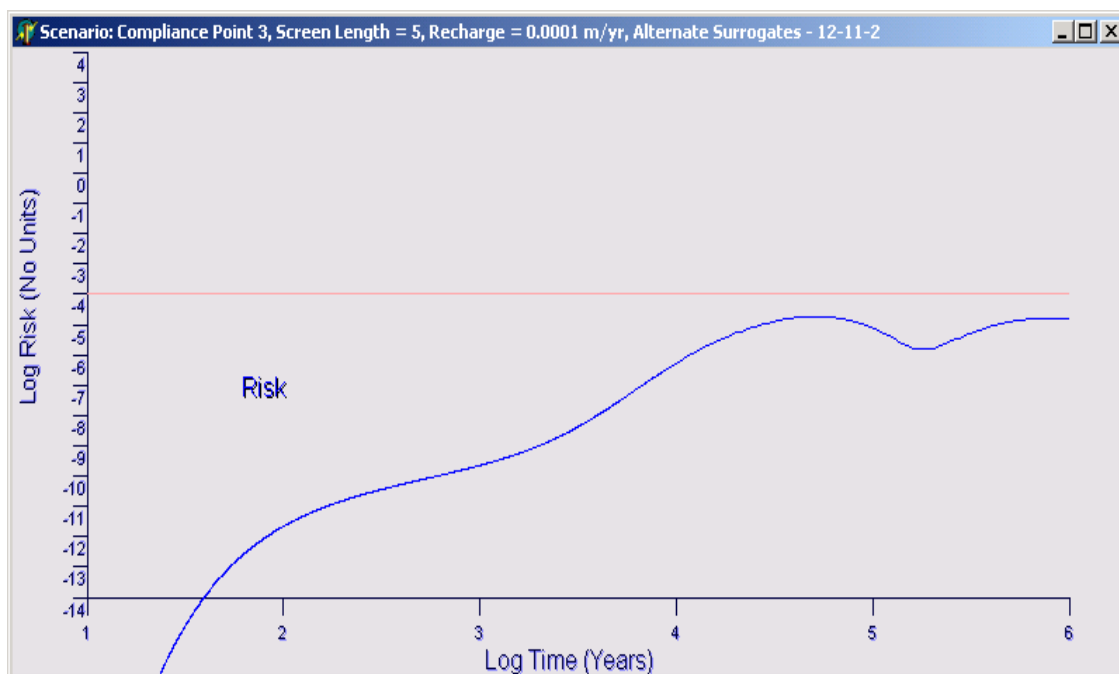


Figure A-1. Adjusted excess lifetime cancer risk curve.

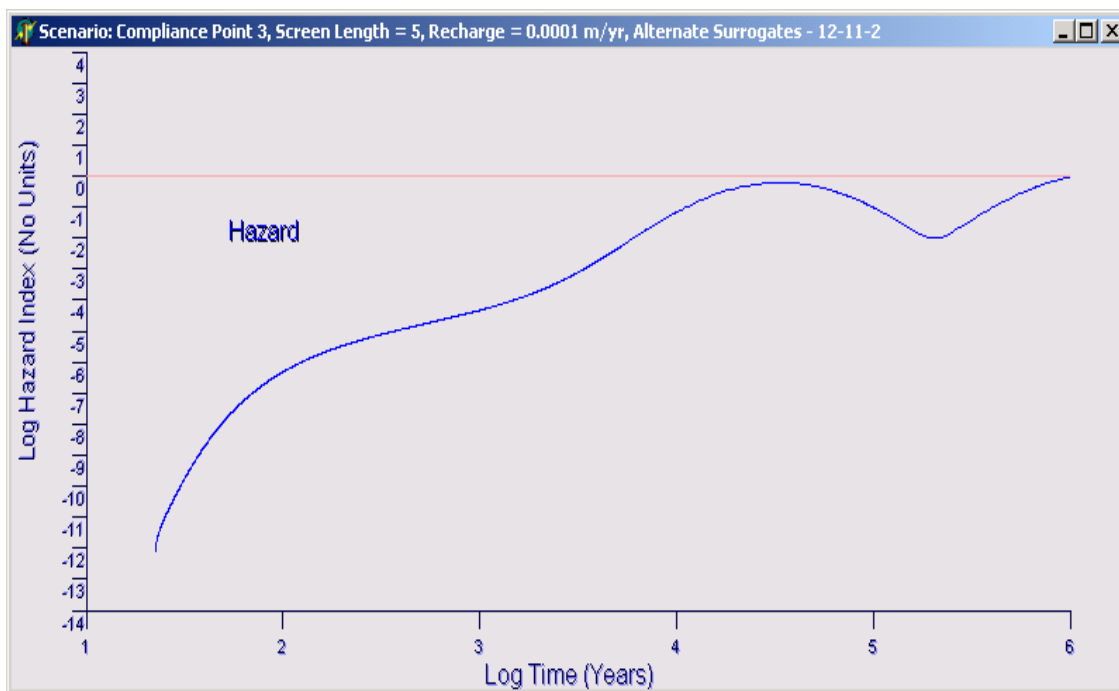


Figure A-2. Adjusted hazard index curve.

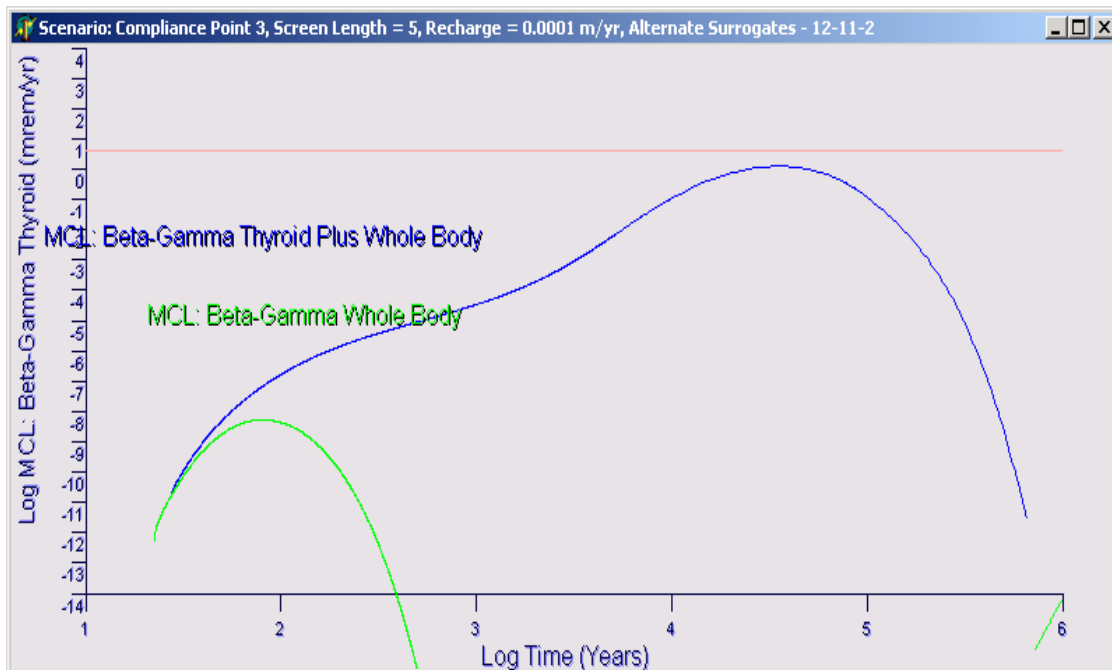


Figure A-3. Adjusted maximum contaminant level—beta and photon emitter curve for thyroid and total body.

The existing background concentrations in the SRPA were reviewed and combined with predicted peak groundwater concentrations (at the design infiltration rate of .0001 m/yr). The combined concentration was then compared against the primary MCL to verify that no exceedence of MCL would occur. Results indicate that combined concentrations do not exceed the primary MCL values, as shown in Table A-1.

A final check is made against the detection limit for the radionuclides. Because the radionuclides in the design inventory were calculated based on a Cesium-137 level, very small concentrations are calculated which are well below typical laboratory detection limits. The detection limit value used for screening all constituents was 1 pCi/g. When the 1 pCi/g detection limit exceeds the adjusted value, the value is eliminated from the WAC limits and is explained as “Below Detection Limit.” However, if a constituent was detected in the historical data, the constituent was retained. All of these constituents were used in determining the cumulative risk values, but these constituents will be tracked in the WAC by the Cesium-137 concentration. If Cs-137 is below the WAC limit, then all of these radionuclides with very small concentrations will also be within their respective limits.

Table A-1. Comparison of ICDF contribution to Snake River Plain Aquifer at design recharge rate (0.0001 m/yr).

Constituent	SRPA Background		MCL Concentration ^b mg/L	Background as Fraction of MCL	WAC Guide Soil Concentration ^c mg/kg	Predicted Peak Ground water Concentration ^d mg/L	Combined Concentration ^e mg/L	Combine Concentrate as Fraction MCL ^f
	Mean Concentration in Groundwater ^a µg/L	mg/L						
Arsenic	1.9	1.9E-03	5.0E-02	0.04	5.8E+01	4.1E-03	6.0E-03	0.12
Barium	66	6.6E-02	2.0E+00	0.03	3.0E+03	2.4E-03	6.8E-02	0.03
Cadmium	<1	1.0E-03	5.0E-03	0.20	3.6E+03	3.4E-03	4.4E-03	0.88
Chromium	12	1.2E-02	1.0E-01	0.12	4.1E+04	3.6E-02	4.8E-02	0.48
Lead	<5	5.0E-03	1.5E-02	0.33	5.8E+04	3.5E-03	8.5E-03	0.57
Mercury	<0.1	1.0E-04	2.0E-03	0.05	9.5E+03	4.6E-04	5.6E-04	0.28
Selenium	1.1	1.1E-03	5.0E-02	0.02	8.5E+02	8.0E-04	1.9E-03	0.04
Silver	1	1.0E-03	NL	NL	9.8E+03	8.0E-04	1.8E-03	NL
Fluoride	0.3	3.0E-04	4.0E+00	0.00	3.9E+03	5.3E-01	5.3E-01	0.13
Nitrate (as NO ₃) ^g	8.1	8.1E-03	4.4E+01	0.00	3.9E+03	5.3E-01	5.4E-01	0.01

a. Based on existing INEEL background data (DOE/ID-22094); < (less than) values are converted to mg/L assuming the value stated.

b. MCL Concentration from EPA at www.epa.gov/safewater/mcl.html. NL indicates no primary MCL established. Secondary MCLs were not assessed.

c. From Table A-2.

d. Peak groundwater concentration using WAC guide soil concentration as modeled in this appendix.

e. Combined value adds the predicted peak groundwater concentration at WAC guide waste soil concentration and SRPA background mean concentrations.

f. Comparison of the combined value against the MCL value. Presented as a fraction of the applicable MCL value.

g. The nitrate (measured as nitrogen) background value is 1.86 µg/L. This converted to nitrate (as nitrate), based on previous calculations as follows:

nitrate (as N) / % nitrogen in nitrate = nitrate (as nitrate) – or– 1.86 µg/L / .23=8.1 µg/L.

MCL = maximum contaminant level

NL = no limit

SRPA = Snake River Plain Aquifer

WAC = Waste Acceptance Criteria

A-4. CONCLUSIONS

The allowable concentrations of constituents in the waste soil that will be placed in the ICDF were calculated in order to be protective of groundwater. These selected allowable waste soil concentrations are shown in Table A-2. The C_{DI} and basis for adjustment are included in the table.

Table A-2. Selected allowable waste soil concentrations based on remedial action objectives.

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Ac225	Rad	5.12E-05	5.12E-02	Below Detection Limit
Ac227	Rad	2.04E-02	2.04E+01	Below Detection Limit
Ac228	Rad	1.52E-07	1.52E-04	Below Detection Limit
Ag106	Rad	0.00E+00	1.00E-10	Below Detection Limit
Ag108	Rad	3.69E-06	No Limit	Below Detection Limit
Ag108m	Rad	8.00E+02	8.00E+05	Cumulative Groundwater
Ag109m	Rad	4.92E-09	No Limit	Below Detection Limit
Ag110	Rad	5.18E-08	No Limit	Below Detection Limit
Ag110m	Rad	5.55E-06	5.55E-03	Below Detection Limit
Ag111	Rad	0.00E+00	1.00E-10	Below Detection Limit
Am241	Rad	2.38E+04	2.38E+07	Cumulative Groundwater
Am242	Rad	4.53E-02	4.53E+01	Below Detection Limit
Am242m	Rad	4.52E-02	4.52E+01	Below Detection Limit
Am243	Rad	3.34E-01	3.34E+02	Cumulative Groundwater
Am245	Rad	0.00E+00	1.00E-10	Below Detection Limit
Am246	Rad	1.38E-22	1.00E-10	Below Detection Limit
At217	Rad	5.12E-05	5.12E-02	Below Detection Limit
Ba136m	Rad	0.00E+00	No Limit	Below Detection Limit
Ba137m	Rad	2.31E+07	No Limit	Cumulative Groundwater
Ba140	Rad	0.00E+00	1.00E-10	Below Detection Limit
Be10	Rad	1.14E-03	1.14E+00	Below Detection Limit
Bi210	Rad	1.09E-03	1.09E+00	Below Detection Limit
Bi211	Rad	1.83E-02	1.83E+01	Below Detection Limit
Bi212	Rad	5.53E-01	5.53E+02	Below Detection Limit
Bi213	Rad	0.00E+00	1.00E-10	Below Detection Limit
Bi214	Rad	5.62E-03	5.62E+00	Below Detection Limit
Bk249	Rad	2.16E-18	1.00E-10	Below Detection Limit
Bk250	Rad	7.75E-23	1.00E-10	Below Detection Limit

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
C14	Rad	4.61E-02	3.00E+03	Cumulative Groundwater
Cd109	Rad	4.92E-09	4.92E-06	Below Detection Limit
Cd113m	Rad	1.62E+03	1.62E+06	Cumulative Groundwater
Cd115m	Rad	4.25E-51	1.00E-10	Below Detection Limit
Ce141	Rad	1.80E-68	1.00E-10	Below Detection Limit
Ce142	Rad	0.00E+00	No Limit	Below Detection Limit
Ce144	Rad	1.81E+00	1.81E+03	Cumulative Groundwater
Cf249	Rad	4.12E-13	1.00E-10	Below Detection Limit
Cf250	Rad	2.11E-13	1.00E-10	Below Detection Limit
Cf251	Rad	9.52E-16	1.00E-10	Below Detection Limit
Cf252	Rad	2.24E-17	1.00E-10	Below Detection Limit
Cm241	Rad	1.30E-77	1.00E-10	Below Detection Limit
Cm242	Rad	5.39E-14	5.00E+01	Below Detection Limit
Cm243	Rad	3.55E-03	3.55E+00	Below Detection Limit
Cm244	Rad	1.80E+00	1.80E+03	Below Detection Limit
Cm245	Rad	8.02E-05	8.02E-02	Below Detection Limit
Cm246	Rad	1.79E-06	1.79E-03	Below Detection Limit
Cm247	Rad	6.39E-13	1.00E-10	Below Detection Limit
Cm248	Rad	1.95E-13	1.00E-10	Below Detection Limit
Cm250	Rad	5.53E-22	1.00E-10	Below Detection Limit
Co57	Rad	3.69E+00	3.69E+03	Cumulative Groundwater
Co58	Rad	5.88E-14	1.00E-10	Below Detection Limit
Co60	Rad	1.93E+05	1.93E+08	Cumulative Groundwater
Cr51	Rad	2.30E-51	1.00E-10	Below Detection Limit
Cs132	Rad	0.00E+00	1.00E-10	Below Detection Limit
Cs134	Rad	1.12E+04	1.12E+07	Cumulative Groundwater
Cs135	Rad	3.58E+01	3.58E+04	Below Detection Limit
Cs136	Rad	0.00E+00	1.00E-10	Below Detection Limit
Cs137	Rad	2.44E+07	2.44E+10	Cumulative Groundwater
Er169	Rad	0.00E+00	1.00E-10	Below Detection Limit
Eu150	Rad	1.73E-05	1.73E-02	Below Detection Limit
Eu152	Rad	9.68E+05	9.68E+08	Cumulative Groundwater
Eu154	Rad	8.21E+05	8.21E+08	Cumulative Groundwater

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Eu155	Rad	1.76E+05	1.76E+08	Cumulative Groundwater
Eu156	Rad	0.00E+00	1.00E-10	Below Detection Limit
Fe55	Rad	2.00E+09	2.00E+12	Cumulative Groundwater
Fe59	Rad	4.51E-32	1.00E-10	Below Detection Limit
Fr221	Rad	5.12E-05	5.12E-02	Below Detection Limit
Fr223	Rad	2.82E-04	2.82E-01	Below Detection Limit
Gd152	Rad	2.72E-11	1.00E-10	Below Detection Limit
Gd153	Rad	2.01E-08	2.01E-05	Below Detection Limit
H3	Rad	4.96E+04	4.96E+07	Cumulative Groundwater
Hf181	Rad	7.80E-34	1.00E-10	Below Detection Limit
Ho166m	Rad	2.70E-03	2.70E+00	Below Detection Limit
I129	Rad	1.30E+03	3.11E+03	Cumulative Groundwater
I131	Rad	0.00E+00	1.00E-10	Below Detection Limit
In114	Rad	1.89E-51	No Limit	Below Detection Limit
In114m	Rad	1.97E-51	1.00E-10	Below Detection Limit
In115	Rad	5.78E-09	5.78E-06	Below Detection Limit
In115m	Rad	0.00E+00	1.00E-10	Below Detection Limit
K40	Rad	1.92E+03	2.40E+05	Cumulative Groundwater
Kr81	Rad	5.30E-06	No Limit	Below Detection Limit
Kr85	Rad	1.16E+06	No Limit	Cumulative Groundwater
La138	Rad	0.00E+00	1.00E-10	Below Detection Limit
La140	Rad	2.65E-102	1.00E-10	Below Detection Limit
Mn54	Rad	1.93E-05	1.00E+02	Below Detection Limit
Nb92	Rad	6.35E-16	No Limit	Below Detection Limit
Nb93m	Rad	1.35E+01	1.35E+04	Below Detection Limit
Nb94	Rad	8.83E-03	No Limit	Below Detection Limit
Nb95	Rad	4.80E-30	1.00E-10	Below Detection Limit
Nb95m	Rad	1.84E-32	1.00E-10	Below Detection Limit
Nd144	Rad	3.27E-07	3.27E-04	Below Detection Limit
Nd147	Rad	0.00E+00	1.0630E-10	Below Detection Limit
Ni59	Rad	9.50E+06	9.50E+09	Cumulative Groundwater
Ni63	Rad	6.00E+07	6.00E+10	Cumulative Groundwater
Nd147	Rad	0.00E+00	1.00E-10	Below Detection Limit

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Np235	Rad	6.80E-08	6.80E-05	Below Detection Limit
Np236	Rad	6.93E-05	6.93E-02	Below Detection Limit
Np237	Rad	6.43E+02	6.43E+05	Cumulative Groundwater
Np238	Rad	2.18E-04	2.18E-01	Below Detection Limit
Np239	Rad	3.34E-01	3.34E+02	Below Detection Limit
Np240	Rad	2.79E-11	1.00E-10	Below Detection Limit
Np240m	Rad	2.54E-08	No Limit	Below Detection Limit
Pa231	Rad	6.98E-02	6.98E+01	Below Detection Limit
Pa233	Rad	4.36E+01	4.36E+04	Below Detection Limit
Pa234	Rad	2.74E-03	No Limit	Below Detection Limit
Pa234m	Rad	1.71E+00	1.71E+03	Below Detection Limit
Pb209	Rad	4.85E-05	4.85E-02	Below Detection Limit
Pb210	Rad	1.09E-03	1.09E+00	Below Detection Limit
Pb211	Rad	1.83E-02	1.83E+01	Below Detection Limit
Pb212	Rad	5.53E-01	5.53E+02	Below Detection Limit
Pb214	Rad	5.62E-03	5.62E+00	Below Detection Limit
Pd107	Rad	6.12E+00	6.12E+03	Below Detection Limit
Pm146	Rad	5.81E+00	5.81E+03	Below Detection Limit
Pm147	Rad	3.82E+05	3.82E+08	Cumulative Groundwater
Pm148	Rad	3.97E-56	1.00E-10	Below Detection Limit
Pm148m	Rad	8.23E-55	1.00E-10	Below Detection Limit
Po210	Rad	1.02E-03	1.02E+00	Below Detection Limit
Po211	Rad	6.84E-07	6.84E-04	Below Detection Limit
Po212	Rad	3.28E-01	3.28E+02	Below Detection Limit
Po213	Rad	4.34E-05	4.34E-02	Below Detection Limit
Po214	Rad	5.62E-03	5.62E+00	Below Detection Limit
Po215	Rad	1.83E-02	1.83E+01	Below Detection Limit
Po216	Rad	5.53E-01	5.53E+02	Below Detection Limit
Po218	Rad	5.62E-03	5.62E+00	Below Detection Limit
Pr143	Rad	0.00E+00	1.00E-10	Below Detection Limit
Pr144	Rad	1.77E+00	No Limit	Below Detection Limit
Pr144m	Rad	2.53E-02	2.53E+01	Below Detection Limit
Pu236	Rad	5.53E-03	5.53E+00	Below Detection Limit

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Pu237	Rad	1.21E-55	1.00E-10	Below Detection Limit
Pu238	Rad	2.33E+05	2.33E+08	Cumulative Groundwater
Pu239	Rad	6.66E+03	6.66E+06	Cumulative Groundwater
Pu240	Rad	1.50E+03	1.50E+06	Cumulative Groundwater
Pu241	Rad	6.39E+04	6.39E+07	Cumulative Groundwater
Pu242	Rad	2.41E-01	2.41E+02	Below Detection Limit
Pu243	Rad	6.39E-13	1.00E-10	Below Detection Limit
Pu244	Rad	2.54E-08	2.54E-05	Below Detection Limit
Pu246	Rad	1.38E-22	1.00E-10	Below Detection Limit
Ra222	Rad	1.17E-113	1.00E-10	Below Detection Limit
Ra223	Rad	2.03E-02	2.03E+01	Below Detection Limit
Ra224	Rad	5.53E-01	5.53E+02	Below Detection Limit
Ra225	Rad	5.12E-05	5.12E-02	Below Detection Limit
Ra226	Rad	4.74E+02	4.74E+05	Cumulative Groundwater
Ra228	Rad	1.52E-07	2.70E+03	Below Detection Limit
Rb86	Rad	0.00E+00	1.00E-10	Below Detection Limit
Rb87	Rad	1.11E-02	1.11E+01	Below Detection Limit
Rh102	Rad	2.97E-02	2.97E+01	Below Detection Limit
Rh103m	Rad	2.83E-55	1.00E-10	Below Detection Limit
Rh106	Rad	1.14E+01	No Limit	Below Detection Limit
Rn218	Rad	1.26E-113	1.00E-10	Below Detection Limit
Rn219	Rad	2.03E-02	2.03E+01	Below Detection Limit
Rn220	Rad	5.53E-01	5.53E+02	Below Detection Limit
Rn222	Rad	6.21E-03	6.21E+00	Below Detection Limit
Ru103	Rad	2.01E-26	1.00E-10	Below Detection Limit
Ru106	Rad	1.21E+01	1.21E+04	Cumulative Groundwater
Sb124	Rad	2.07E-37	1.00E-10	Below Detection Limit
Sb125	Rad	9.27E+03	9.27E+06	Cumulative Groundwater
Sb126	Rad	2.06E+01	2.06E+04	Below Detection Limit
Sb126m	Rad	1.47E+02	1.47E+05	Below Detection Limit
Sc46	Rad	2.85E-17	1.00E-10	Below Detection Limit
Se79	Rad	1.66E+02	1.66E+05	Below Detection Limit
Sm146	Rad	4.26E-07	4.26E-04	Below Detection Limit

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Sm147	Rad	4.10E-03	4.10E+00	Below Detection Limit
Sm148	Rad	1.01E-09	1.01E-06	Below Detection Limit
Sm149	Rad	5.12E-09	5.12E-06	Below Detection Limit
Sm151	Rad	3.38E+05	3.38E+08	Cumulative Groundwater
Sn117m	Rad	0.00E+00	1.00E-10	Below Detection Limit
Sn119m	Rad	1.48E-04	1.48E-01	Below Detection Limit
Sn121m	Rad	2.69E+01	2.69E+04	Below Detection Limit
Sn123	Rad	8.42E-14	1.00E-10	Below Detection Limit
Sn125	Rad	0.00E+00	1.00E-10	Below Detection Limit
Sn126	Rad	1.47E+02	1.47E+05	Below Detection Limit
Sr89	Rad	5.99E-41	5.00E+02	Below Detection Limit
Sr90	Rad	2.29E+07	2.29E+10	Cumulative Groundwater
Tb160	Rad	3.18E-31	1.00E-10	Below Detection Limit
Tb161	Rad	0.00E+00	1.00E-10	Below Detection Limit
Tc98	Rad	1.77E-04	1.77E-01	Below Detection Limit
Tc99	Rad	5.76E+03	5.76E+06	Cumulative Groundwater
Te123	Rad	4.52E-12	1.00E-10	Below Detection Limit
Te123m	Rad	2.95E-20	1.00E-10	Below Detection Limit
Te125m	Rad	2.27E+03	2.27E+06	Cumulative Groundwater
Te127	Rad	9.36E-17	1.00E-10	Below Detection Limit
Te127m	Rad	9.50E-17	1.00E-10	Below Detection Limit
Te129	Rad	6.75E-68	1.00E-10	Below Detection Limit
Te129m	Rad	1.07E-67	1.00E-10	Below Detection Limit
Th226	Rad	2.18E-114	1.00E-10	Below Detection Limit
Th227	Rad	1.82E-02	1.82E+01	Below Detection Limit
Th228	Rad	3.29E+01	1.60E+04	Cumulative Groundwater
Th229	Rad	5.12E-05	5.12E-02	Below Detection Limit
Th230	Rad	1.73E+02	1.40E+04	Cumulative Groundwater
Th231	Rad	1.61E+02	1.61E+05	Below Detection Limit
Th232	Rad	1.56E+02	1.68E+04	Cumulative Groundwater
Th234	Rad	1.71E+00	1.71E+03	Below Detection Limit
T1207	Rad	1.83E-02	No Limit	Below Detection Limit
T1208	Rad	1.98E-01	No Limit	Below Detection Limit

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
T1209	Rad	1.05E-06	No Limit	Below Detection Limit
Tm170	Rad	6.38E-23	1.00E-10	Below Detection Limit
Tm171	Rad	1.59E-09	1.59E-06	Below Detection Limit
U230	Rad	0.00E+00	1.00E-10	Below Detection Limit
U232	Rad	5.35E-01	5.35E+02	Below Detection Limit
U233	Rad	1.6E+05	1.6E+08	Cumulative Groundwater
U234	Rad	6.03E+03	6.03E+06	Cumulative Groundwater
U235	Rad	1.10E+02	1.10E+05	Cumulative Groundwater
U236	Rad	2.02E+02	2.02E+05	Cumulative Groundwater
U237	Rad	0.00E+00	1.00E-10	Below Detection Limit
U238	Rad	1.95E+03	1.95E+06	Cumulative Groundwater
U240	Rad	2.54E-08	2.54E-05	Below Detection Limit
Xe127	Rad	1.58E-69	No Limit	Below Detection Limit
Xe129m	Rad	0.00E+00	No Limit	Below Detection Limit
Xe131m	Rad	2.69E-109	No Limit	Below Detection Limit
Xe133	Rad	0.00E+00	No Limit	Below Detection Limit
Y90	Rad	2.29E+07	2.29E+10	Cumulative Groundwater
Y91	Rad	4.14E-34	1.00E-10	Below Detection Limit
Zn65	Rad	2.70E-06	1.00E+02	Below Detection Limit
Zr93	Rad	8.57E+02	8.57E+05	Below Detection Limit
Zr95	Rad	2.93E-22	1.00E-10	Below Detection Limit
1,1,1-Trichloroethane	Organic	1.57E-02	1.57E+01	Design Inventory × 1000
1,1,2,2-Tetrachloroethane	Organic	4.95E-05	4.95E-02	Design Inventory × 1000
1,1,2-Trichloroethane	Organic	2.42.E-04	2.42.E-01	Design Inventory × 1000
1,1-Dichloroethane	Organic	2.34E-03	2.34E+00	Design Inventory × 1000
1,1-Dichloroethene	Organic	1.48E-03	1.48E+00	Design Inventory × 1000
1,2,3,4,6,7,8,9-OCDD	Organic	6.9E-02	6.9E+01	Cumulative Groundwater
1,2,3,4,6,7,8,9-OCDF	Organic	1.4E-02	1.4E+01	Cumulative Groundwater
1,2,3,4,6,7,8-HpCDD	Organic	4.6E-02	4.6E+01	Cumulative Groundwater
1,2,3,4,6,7,8-HpCDF	Organic	1.2E-01	1.2E+02	Cumulative Groundwater
1,2,3,4,7,8,9-HpCDF	Organic	5.9E-04	5.9E-01	Cumulative Groundwater
1,2,3,4,7,8-HxCDD	Organic	1.1E-04	1.1E-01	Cumulative Groundwater
1,2,3,4,7,8-HxCDF	Organic	2.0E-01	2.0E+02	Cumulative Groundwater

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
1,2,3,6,7,8-HxCDD	Organic	8.4E-04	8.4E-01	Cumulative Groundwater
1,2,3,6,7,8-HxCDF	Organic	1.0E-02	1.0E+01	Cumulative Groundwater
1,2,3,7,8,9-HxCDD	Organic	2.4E-03	2.4E+00	Cumulative Groundwater
1,2,3,7,8,9-HxCDF	Organic	2.2E-05	2.2E-02	Cumulative Groundwater
1,2,3,7,8-PeCDD	Organic	1.1E-04	1.1E-01	Cumulative Groundwater
1,2,3,7,8-PeCDF	Organic	9.3E-04	9.3E-01	Cumulative Groundwater
1,2,4-Trichlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
1,2-Dichlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
1,2-Dichloroethane	Organic	2.5E+01	2.5E+04	Cumulative Groundwater
1,2-Dichloroethene	Organic	5.38E-06	5.38E-03	Design Inventory × 1000
1,2-Dichloroethene (total)	Organic	3.24E-04	3.24E-01	Design Inventory × 1000
1,3-Dichlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
1,4-Dichlorobenzene	Organic	4.50E-01	4.50E+02	Design Inventory × 1000
1,4-Dioxane	Organic	1.88E-05	1.88E-02	Design Inventory × 1000
2,3,4,6,7,8-HxCDF	Organic	1.6E-02	1.6E+01	Cumulative Groundwater
2,3,4,7,8-PeCDF	Organic	6.3E-03	6.3E+00	Cumulative Groundwater
2,3,7,8-TCDD	Organic	4.1E-06	4.1E-03	Cumulative Groundwater
2,3,7,8-TCDF	Organic	5.5E-02	5.5E+01	Cumulative Groundwater
2,4,5-Trichlorophenol	Organic	4.46E-02	4.46E+01	Design Inventory × 1000
2,4,6-Trichlorophenol	Organic	1.83E-02	1.83E+01	Design Inventory × 1000
2,4-Dichlorophenol	Organic	2.16E-02	2.16E+01	Design Inventory × 1000
2,4-Dimethylphenol	Organic	1.83E-02	1.83E+01	Design Inventory × 1000
2,4-Dinitrophenol	Organic	5.09E-02	5.09E+01	Design Inventory × 1000
2,4-Dinitrotoluene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
2,6-Dinitrotoluene	Organic	2.07E-02	2.07E+01	Design Inventory × 1000
2-Butanone	Organic	2.47E-02	2.47E+01	Design Inventory × 1000
2-Chloronaphthalene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
2-Chlorophenol	Organic	1.83E-02	1.83E+01	Design Inventory × 1000
2-Hexanone	Organic	2.70E-03	2.70E+00	Design Inventory × 1000
2-Methylnaphthalene	Organic	5.12E-01	5.12E+02	Design Inventory × 1000
2-Methylphenol	Organic	2.06E-02	2.06E+01	Design Inventory × 1000
2-Nitroaniline	Organic	3.4E+00	3.4E+03	Cumulative Groundwater

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
2-Nitrophenol	Organic	1.83E-02	1.83E+01	Design Inventory × 1000
3,3'-Dichlorobenzidine	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
3-Methyl Butanol	Organic	2.23E-04	No Limit	No RAO Limits
3-Nitroaniline	Organic	3.4E+00	3.4E+03	Cumulative Groundwater
4,6-Dinitro-2-methylphenol	Organic	4.46E-02	4.46E+01	Design Inventory × 1000
4-Bromophenyl-phenylether	Organic	1.14E-02	No Limit	No RAO Limits
4-Chloro-3-methylphenol	Organic	1.83E-02	No Limit	No RAO Limits
4-Chloroaniline	Organic	4.08E-02	4.12E+01	Design Inventory × 1000
4-Chlorophenyl-phenylether	Organic	1.14E-02	No Limit	No RAO Limits
4-Methyl-2-Pentanone	Organic	2.96E-02	2.96E+01	Design Inventory × 1000
4-Methylphenol	Organic	3.86E-02	3.86E+01	Design Inventory × 1000
4-Nitroaniline	Organic	3.4E+00	3.4E+03	Cumulative Groundwater
4-Nitrophenol	Organic	5.16E-02	5.16E+01	Design Inventory × 1000
Acenaphthene	Organic	2.02E-01	2.02E+02	Design Inventory × 1000
Acenaphthylene	Organic	2.07E-02	2.07E+01	Design Inventory × 1000
Acetone	Organic	6.20E-01	6.20E+02	Design Inventory × 1000
Acetonitrile	Organic	1.88E-05	1.16E+00	Adjusted to Exceed Maximum Concentration
Acrolein	Organic	9.06E-06	5.47E-01	Adjusted to Exceed Maximum Concentration
Acrylonitrile	Organic	9.06E-06	5.83E-01	Adjusted to Exceed Maximum Concentration
Anthracene	Organic	3.20E-01	3.20E+02	Design Inventory × 1000
Aramite	Organic	1.15E-04	6.71E+00	Adjusted to Exceed Maximum Concentration
Aroclor-1016	Organic	7.69E-03	7.69E+00	Design Inventory × 1000
Aroclor-1254	Organic	1.28E-01	1.28E+02	Design Inventory × 1000
Aroclor-1260	Organic	7.21E-01	7.21E+02	Design Inventory × 1000
Aroclor-1262	Organic	5.0E+00	5.0E+03	Cumulative Groundwater
Aroclor-1268	Organic	6.22E-02	6.22E+01	Design Inventory × 1000
Benzene	Organic	6.03E-01	6.03E+02	Design Inventory × 1000
Benzidine	Organic	2.91E-04	1.72E+01	Adjusted to Exceed Maximum Concentration
Benzo(a)anthracene	Organic	2.53E-01	2.53E+02	Design Inventory × 1000

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Benzo(a)pyrene	Organic	1.05E-01	1.05E+02	Design Inventory × 1000
Benzo(b)fluoranthene	Organic	1.79E-01	1.79E+02	Design Inventory × 1000
Benzo (g,h,i)perylene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Benzo(k)fluoranthene	Organic	1.86E-02	1.86E+01	Design Inventory × 1000
Benzoic acid	Organic	8.56E-03	8.56E+00	Design Inventory × 1000
bis(2-Chloroethoxy)methane	Organic	1.14E-02	No Limit	No RAO Limits
bis(2-Chloroethyl)ether	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
bis(2-Chloroisopropyl)ether	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
bis(2-Ethylhexyl)phthalate	Organic	1.47E-01	1.47E+02	Design Inventory × 1000
Bromomethane	Organic	4.0E+00	4.0E+03	Cumulative Groundwater
Butane, 1,1,3,4-Tetrachloro-	Organic	7.89E-03	No Limit	No RAO Limits
Butylbenzylphthalate	Organic	6.79E-02	6.79E+01	Design Inventory × 1000
Carbazole	Organic	3.23E-02	3.23E+01	Design Inventory × 1000
Carbon Disulfide	Organic	4.55E-02	4.55E+01	Design Inventory × 1000
Chlorobenzene	Organic	6.57E-03	6.57E+00	Design Inventory × 1000
Chloroethane	Organic	3.02E-06	1.47E-01	Adjusted to Exceed Maximum Concentration
Chloromethane	Organic	3.53E-04	3.53E-01	Design Inventory × 1000
Chrysene	Organic	2.65E-01	2.65E+02	Design Inventory × 1000
Decane, 3,4-Dimethyl	Organic	1.61E-04	No Limit	No RAO Limits
Diacetone alcohol	Organic	4.32E+00	No Limit	No RAO Limits
Dibenz(a,h)anthracene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Dibenzofuran	Organic	3.24E-01	3.24E+02	Design Inventory × 1000
Dichlorodifluoromethane	Organic	1.17E+00	1.7E+03	Cumulative Groundwater
Diethylphthalate	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Dimethyl Disulfide	Organic	2.96E-03	No Limit	No RAO Limits
Dimethylphthalate	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Di-n-butylphthalate	Organic	2.39E-02	2.39E+01	Design Inventory × 1000
Di-n-octylphthalate	Organic	2.62E-02	2.62E+01	Design Inventory × 1000
Eicosane	Organic	2.83E-03	No Limit	No RAO Limits
Ethyl cyanide	Organic	1.88E-05	No Limit	No RAO Limits
Ethylbenzene	Organic	7.81E-02	7.81E+01	Design Inventory × 1000
Famphur	Organic	5.81E-05	No Limit	No RAO Limit

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Fluoranthene	Organic	7.62E-01	7.62E+02	Design Inventory × 1000
Fluorene	Organic	1.84E-01	1.84E+02	Design Inventory × 1000
Heptadecane, 2,6,10,15-Tetra	Organic	3.44E-03	No Limit	No RAO Limits
Hexachlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Hexachlorobutadiene	Organic	2.07E-02	2.07E+01	Design Inventory × 1000
Hexachlorocyclopentadiene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Hexachloroethane	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Indeno(1,2,3-cd)pyrene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Isobutyl alcohol	Organic	1.88E-05	1.16E+00	Adjusted to Exceed Maximum Concentration
Isophorone	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Isopropyl Alcohol/2-propanol	Organic	2.12E-03	No Limit	No RAO Limits
Kepone	Organic	9.92E-02	9.92E+01	Design Inventory × 1000
Mesityl oxide	Organic	8.48E-02	No Limit	No RAO Limits
Methyl Acetate	Organic	4.84E-04	4.84E-01	Design Inventory × 1000
Methylene Chloride	Organic	8.36E-02	8.36E+01	Design Inventory × 1000
Naphthalene	Organic	4.25E-01	4.25E+02	Design Inventory × 1000
Nitrobenzene	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
N-Nitroso-di-n-propylamine	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
N-Nitrosodiphenylamine	Organic	1.14E-02	1.14E+01	Design Inventory × 1000
Octane,2,3,7-Trimethyl	Organic	1.61E-04	No Limit	No RAO Limits
o-Toluenesulfonamide	Organic	5.06E-03	No Limit	No RAO Limits
Pentachlorophenol	Organic	5.59E-02	5.59+01	Design Inventory × 1000
Phenanthrene	Organic	1.17+00	1.17E+03	Design Inventory × 1000
Phenol	Organic	7.98E-02	7.98E+01	Design Inventory × 1000
Phenol,2,6-Bis(1,1-Dimethyl)	Organic	4.05E-03	No Limit	No RAO Limits
Polyvinyl Chloride	Organic	2.7E+03	NA	NA
p-Toluenesulfonamide	Organic	5.06E-03	No Limit	No RAO Limits
Pyrene	Organic	2.53E-01	2.53E+02	Design Inventory × 1000
RDX	Organic	0.00E+00	1.04E+01	Adjusted based on anticipated concentrations
Styrene	Organic	4.3E+04	4.3E+07	Cumulative Groundwater

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Tetrachloroethene	Organic	9.64E-03	9.64E+00	Design Inventory × 1000
Toluene	Organic	9.82E-01	9.82E+02	Design Inventory × 1000
Tributylphosphate	Organic	3.64E-01	No Limit	No RAO Limits
Trichloroethene	Organic	7.20E-02	7.20E+01	Design Inventory × 1000
Trinitrotoluene	Organic	0.00E+00	1.11E+01	Adjusted based on anticipated concentrations
Undecane,4,6-Dimethyl	Organic	1.61E-04	No Limit	No RAO Limits
Vinyl Chloride	Organic	1.2E+01	1.2E+04	Cumulative Groundwater
Xylene (ortho)	Organic	3.88E-03	3.88E+00	Design Inventory × 1000
Xylene (total)	Organic	3.45E+00	3.45E+03	Design Inventory × 1000
Aluminum	Inorganic	7.08E+03	1.61E+05	10 × Background
Antimony	Inorganic	5.83E+00	5.83E+03	Design Inventory × 1000
Arsenic	Inorganic	5.65E+00	5.80E+01	10 × Background
Barium	Inorganic	1.79E+02	3.00+03	10 × Background
Beryllium	Inorganic	2.87E-01	1.80E+01	10 × Background
Boron	Inorganic	1.85E+02	3.31E+03	Adjusted to Not Exceed Hazard Index
Bromide	Inorganic	3.6E+00	NA	NA
Cadmium	Inorganic	3.59E+00	3.59E+03	Design Inventory × 1000
Calcium	Inorganic	2.04E+04	No Limit	No RAO Limits
Chloride	Inorganic	1.87E+00	No Limit	No RAO Limits
Chromium	Inorganic	4.12E+01	4.12E+04	Design Inventory × 1000
Cobalt	Inorganic	6.04E+00	1.10E+02	10 × Background
Copper	Inorganic	2.99E+01	2.99E+04	Design Inventory × 1000
Cyanide	Inorganic	3.37E-01	3.37E+02	Design Inventory × 1000
Dysprosium	Inorganic	5.93E+01	5.93E+04	Design Inventory × 1000
Fluoride	Inorganic	3.87E+00	3.87E+03	Design Inventory × 1000
Iron	Inorganic	1.02E+04	2.50E+05	10 × Background
Lead	Inorganic	5.76E+01	5.76E+04	Design Inventory × 1000
Magnesium	Inorganic	4.47E+03	No Limit	No RAO Limits
Manganese	Inorganic	2.07E+02	4.90E+03	10 × Background
Mercury	Inorganic	9.45E+00	9.45E+03	Design Inventory × 1000

Table A-2. (continued).

Constituent ^a Name	Constituent Type	Design Inventory Concentration ^a (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1.0E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Molybdenum	Inorganic	1.02E+01	1.02E+04	Design Inventory × 1000
Nickel	Inorganic	1.97E+01	3.50E+02	10 × Background
Nitrate	Inorganic	3.93E+00	3.93E+03	Design Inventory × 1000
Nitrate/Nitrite-N	Inorganic	2.22E-01	No Limit	No RAO Limits
Nitrite	Inorganic	8.49E-03	8.49E+00	Design Inventory × 1000
Phosphate	Inorganic	5.7E+00	NA	NA
Phosphorus	Inorganic	9.74E+01	No Limit	No RAO Limits
Potassium	Inorganic	1.13E+03	No Limit	No RAO Limits
Selenium	Inorganic	8.46E-01	8.46E+02	Design Inventory × 1000
Silicon	Inorganic	1.6E+04	NA	NA
Silver	Inorganic	9.84+00	9.84E+03	Design Inventory × 1000
Sodium	Inorganic	2.11E+02	No Limit	No RAO Limits
Strontium	Inorganic	1.82E+01	1.82E+04	Design Inventory × 1000
Sulfate	Inorganic	2.05E+01	No Limit	No RAO Limits
Sulfide	Inorganic	7.59E+02	No Limit	No RAO Limits
Terbium	Inorganic	5.73E+02	No Limit	No RAO Limits
Thallium	Inorganic	3.70E-01	4.30E+00	10 × Background
Tin	Inorganic	3.0E+00	3.0E+03	Cumulative Groundwater
Vanadium	Inorganic	2.12E+01	4.50E+02	10 × Background
Ytterbium	Inorganic	1.95E+02	No Limit	No RAO Limits
Zinc	Inorganic	2.08E+02	2.08E+05	Design Inventory × 1000
Zirconium	Inorganic	6.91E+01	No Limit	No RAO Limits

a. Design inventory concentrations for radionuclides were calculated using the design inventory activity for January 1, 2002, averaged over the entire landfill volume at a density of 1,500kg/cubic meter. Design inventory concentrations for organics and inorganics were calculated using the constituent mass from the design inventory averaged over the entire landfill volume at a density of 1,500 kg/cubic meter.

RAO = remedial action objective.